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BY

PAUL ROY SEYMOUR

Pp. 1–100; 10 *Plates*, 113 *Text-figures*, 11 *Maps*

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A REVISION OF THE GENUS *MASALIA* (LEPIDOPTERA : HELIOTHIDINAE)

By P. R. SEYMOUR

CONTENTS

SYNOPSIS

The genus *Masalia* Moore is recalled from synonymy and fully revised. A key is given to the 38 species (three new) and 31 subspecies (five new) recognized as valid. Seventeen specific and two subspecific synonyms are newly established.

MATERIAL STUDIED

THE large collection of Heliothidine moths in the British Museum (Natural History) formed the nucleus of the material used for this revision. Type and other important material was borrowed from collections in the following museums:

Musée Royal de l'Afrique Centrale, Tervuren (MRAC, Tervuren); Museo Civico di Storia Naturale, Genoa (MCSN, Genoa); Museum Alexander Koenig, Bonn (MAK, Bonn); Muséum National d'Histoire Naturelle, Paris (MNHN, Paris); Naturhistoriska Riksmuseet, Stockholm (NR, Stockholm); University Museum, Oxford (UM, Oxford); Museum für Naturkunde der Humboldt-Universität, Berlin (MNHU, Berlin); and Zoologisches Sammlung des Bayerischen Staates, Munich (ZSBS, Munich).

The abbreviations given in brackets are those used throughout the text in listing the material examined.

Specimens were examined of all the species placed in *Timora* Walker, 1856, the genus from which *Masalia* has been extracted and with which it was previously

synonymized. Other species within the subfamily with affinities to *Timora* were also investigated. Except for four, all the holo- or lectotypes of valid names and synonyms now included in *Masalia* have been seen. The four exceptions were *M. epimethea* (Viette), *M. prochaskai* (Viette), *M. leucosticta vinula* (Berio) and *M. lancea* (Berio); for each of these an author-verified specimen was examined and paratype photographs were seen of *vinula* and *lancea*.

ACKNOWLEDGEMENTS

I wish to thank the following specialists for their kindness in lending type and other material: Mons. L. A. Berger, Belgium; Dr E. Berio, Italy; Dr J. Bourgogne, France; Dr H. J. Hannemann, Germany; Mr E. Taylor, England; and Dr E. Todd, U.S.A.

I am also most grateful to Dr W. Forster, Germany; Dr G. Hallin, Sweden; and Dr P. Viette, France, who, in addition to lending material, have given help with this paper in many other ways.

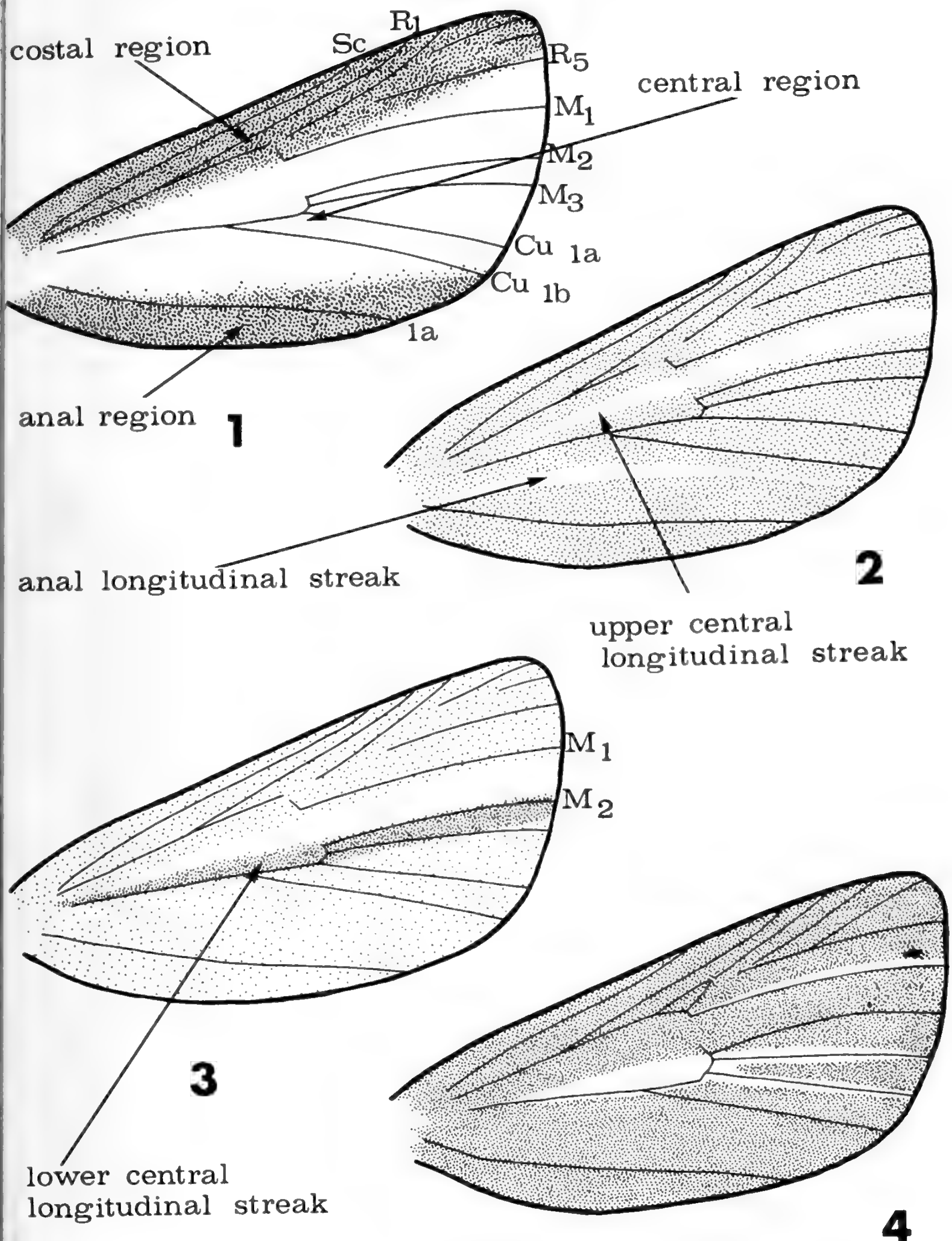
TREATMENT

The layout of the accounts of the species and subspecies has been standardized and arranged in the following sequence: fore and hind wing, genitalia, material examined, distribution, and remarks (diagnosis and comment). Mention is made of the antennae, proboscis quotient and 8th abdominal tergum only when these differ from the norm or, in the case of the antennae, when they are sexually dimorphic. The 'proboscis quotient' is the length of the proboscis divided by the length of the long axis of the eye.

The presence or absence of an areole in the fore wing and the fore wing length are stated; the latter is measured from the fore wing apex to the centre of the mesothorax. The measurements given are in millimetres and are for the smallest and largest specimen of each sex; the number of specimens checked is given in parentheses. Holotype and lectotype measurements have also been included in order to give a standard set of figures, for in a number of the earlier descriptions the points between which measurements were taken was not stated.

Three fore wing regions are recognized: costal, central and anal (shown against fore wing veins in Text-fig. 1). In the descriptions of the pattern, 'upper central longitudinal streak' refers to the streak passing through the radial half of the cell and beyond between M_1 and M_2 (Text-fig. 2); 'lower central longitudinal streak' refers to the streak passing through the cubital half of the cell and beyond between M_2 and M_3 (Text-fig. 3); 'anal longitudinal streak' refers to the streak following the anal fold (Text-fig. 2). The colour terms used refer to the general names given in the colour diagrams of Methuen's 1967 *Handbook of Colour*.

The fore and hind wing upper surface of each species and subspecies has been illustrated by a photograph. Illustrations of variants to indicate the range of variation of wing-pattern found are also included (sex-linked variation is indicated). For the illustrations fresh, well marked specimens were given preference over faded or worn types.



FIGS 1–4. Fore wing longitudinal markings of *Masalia* and their terms. 4, forked lower central longitudinal streak.

The male genitalia is illustrated by figures of the scobinate bar and proximal end of the vesica (Text-fig. 14). Differences centre on bar-shape and on the size and number of spicules. Differences occur both inter- and intraspecifically, and between a number of species there is overlapping variation. Although the diagnostic value of these characters is thereby reduced they are nevertheless particularly important in aiding identification of male specimens, since in the key female characters are often used. Figures of the scobinate bar of all species are included to provide a comparative set. Extremes have been chosen for species having a wide degree of bar variation, whilst for others a typical representative specimen has been used. For the female, figures are given showing the lateral view of the papilla analis of the species and subspecies in which the papilla analis is modified in form.

The data of specimens examined are listed. The information has been taken from their attached labels and, in the case of type-material, from the original descriptions where additional information is recorded. The locality data of type-material is stated as given on the specimen, but changes in country or regional name and in spelling (where traced) have been inserted in square brackets. The changes and alteration to spelling are based on names in the 1965 *Times Index-Gazetteer of the World* and on current usage in African countries whose names have since changed. Other material has been listed geographically to country (using the current country-names) and alphabetically to locality. Unless otherwise stated specimens are in the collection of the British Museum (Natural History).

MASALIA Moore **gen. rev.**

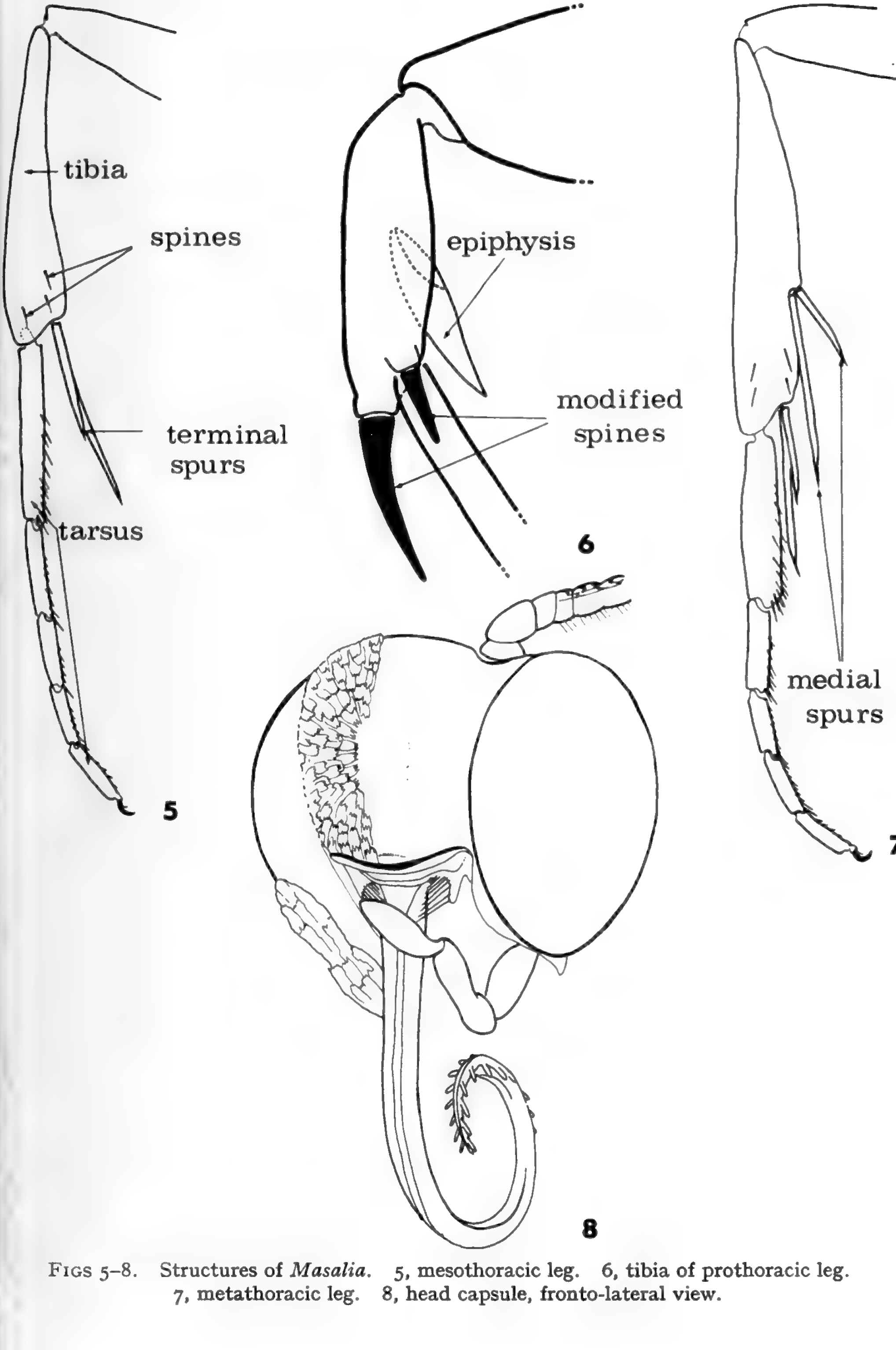
Masalia Moore, 1881: 364. Type-species: *Masalia radiata* Moore, by original designation.
Pradatta Moore, 1881 : 364. Type-species: *Pradatta beatrix* Moore, by original designation. [Synonymized with *Timora* Walker by Hampson, 1903 : 103.]
Curubasa Moore, 1881 : 366. Type-species: *Alaria lanceolata* Walker, by original designation. [Synonymized with *Timora* Walker by Hampson, 1903 : 103.]
[*Timora* Walker; Hampson, 1903 : 103. *Masalia* Moore synonymized with *Timora* Walker.]
Lecerfia Dumont, 1920 : 102. Type-species: *Lecerfia chitinipyga* Dumont, by monotypy. [Synonymized with *Timora* Walker by Draudt, 1935 : 197.]

REDESCRIPTION. *Head.* Clypeus differentiated into a bulbous plate extending well forward from the eyes and a ventral upcurved semicircular plate with a dorsal protruding lip (Text-fig. 8), the bulbous plate clothed in short adpressed, hair-like scales, and the ventral plate glabrous. Proboscis short, proboscis quotient from 2, but only exceptionally exceeding 3; distally bearing numerous well developed sensory papillae. Antenna with 50 to 60 flagellar segments.

THORAX. Prothoracic tibia with an epiphysis and a terminal pair of large modified spines, of which the inner is the shorter (Text-fig. 6), or occasionally with a single modified spine; otherwise without spines. Mesothoracic tibia with a terminal pair of subequal spurs and from 1 to 6 spines distad (Text-fig. 5). Metathoracic tibia with a terminal and medial pair of subequal spurs and from 1 to 6 spines distad, spines restricted to below level of medial spurs (Text-fig. 7).

Wings. Fore wing venation with Sc, R_1, M_1, M_2, M_3, Cu_{1a}, Cu_{1b} and $1A$ as in Text-fig. 9. $2A$ usually absent; when present, weakly developed and anastomosing proximally with $1A$. R_2 to R_5 present, arrangement variable. Areole present or absent; when present, between R_2 and R_{3+4} or R_2 and R_{3+4+5}.

Hind wing venation with $Sc + R_1$ anastomosing proximally or approximating with Rs. M_2 absent (Text-fig. 9). Rs and M_1 either divided or stalked from lower angle of cell; venation otherwise constant.



FIGS 5–8. Structures of *Masalia*. 5, mesothoracic leg. 6, tibia of prothoracic leg. 7, metathoracic leg. 8, head capsule, fronto-lateral view.

Abdomen. Posterior margin of eighth abdominal tergum from straight to centrally emarginate (Text-figs 20, 21).

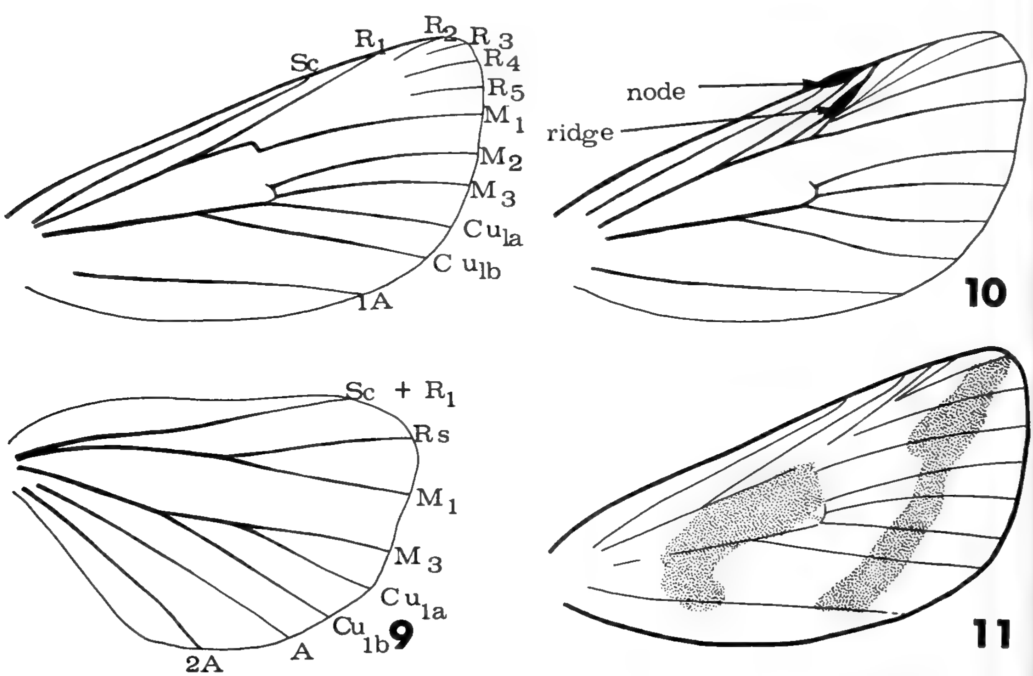
Genitalia. Male with uncus simple, terminally hooked; valve simple, apically slightly dilate, corona spiculate (Text-figs 12, 13). Aedeagus with apex obliquely truncate with a scobinate bar; vesica membranous, slightly spiral and with a scale-like cornutus (Text-fig. 14). Female papilla analis either simple [i.e., membranous and rounded] (Text-figs 15, 16), or modified [sclerotized] and of variable shape being rounded, folded, angled or digitate (Text-figs 17–19). Ductus bursae elongate, corpus bursae with 1 to 4 signa and an appendix bursae; ductus, corpus and appendix bursae membranous, simple or ribbed (Text-figs 15, 18).

DIAGNOSIS. Vesica in males with a proximal scale-like cornutus.

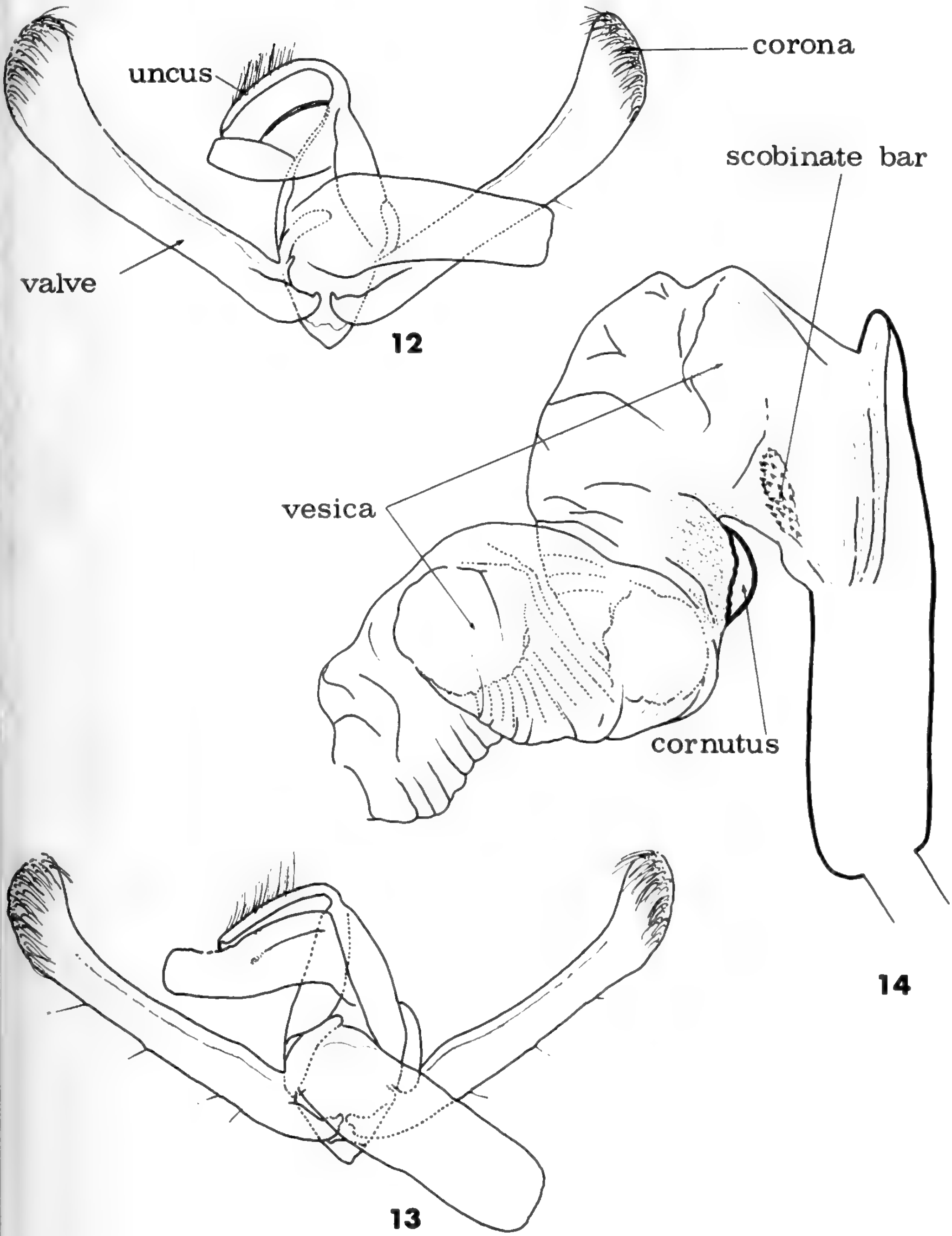
HISTORICAL SURVEY. Moore (1881) erected the genus *Masalia* for two new species *M. radiata* and *M. irrorata,* designating the former as type-species. The second of these two species is now assigned to *Timora* Walker. Moore's paper is descriptive but not diagnostically orientated and reflects a disregard of earlier work.

Masalia was synonymized with *Timora* by Hampson at the beginning of the century and has remained a synonym of it until the present paper. Hampson's revision of *Timora* was important in bringing together a number of naturally related species but, unfortunately, the characters chosen to distinguish species of *Timora* from other genera are inadequate.

Later revisions of *Timora* by Warren (1911, 1913) and Gaede (1935) closely followed the work of Hampson. The names of species subsequently described in



FIGS 9–11. Wing structures and markings of *Masalia.* 9, fore and hind wing venation. 10, *M. perstriata* ♂, fore wing venation. 11, transverse wing markings typical of *decorata*-group species.



FIGS 12–14. Structures of male genitalia of *Masalia*. 12 and 13, valves. 14, aedeagus with everted vesica.

Timora were brought together, but there was much confusion, for few types and little material had been examined. Recent relevant papers are concerned with descriptions of new species and are widely scattered in the literature.

Hampson's (1903) synonymy of *Masalia* with *Timora* was primarily based on prothoracic tibial features, namely the absence of spines except for a single or pair of terminal modified spines. On examining Heliothidine material in the collection of the British Museum (Natural History), the same type of prothoracic tibia was found in nine other genera; the number of species involved was comparatively few (29) but sufficient to discount the value of the prothoracic tibial features at the generic level. Unfortunately, no satisfactory combination of characters could be found to separate *Timora* sensu Hampson from other related genera.

Following investigation of the male genitalia, a scale-like cornutus was found at the proximal end of the vesica in a number of species assigned to *Timora* (but absent in the type-species, *Timora senegalensis* (Guenée). In these species, the cornutus was present in all the specimens examined and was similar in appearance from one species to another and though irregular in form, varied only slightly in position relative to the scobinate bar. On the presence of a cornutus and similarity of other characters these species are regarded as comprising a genus for which the name *Masalia* is recalled from synonymy. Within the Heliothidinae, the vesical armature has been found diagnostic in two other genera, *Helicoverpa* Hardwick, 1965, with a helical row of spicules or spicule clusters, and *Adisura* Moore, 1881, with a small number of elongate terminal spicules.

GENERIC AFFINITIES AND DISTRIBUTION. *Masalia* has affinities with *Timora*, *Adisura* and *Canthylidia* Butler, 1886, but differs from them in the presence in the male of a scale-like cornutus. As in *Masalia* the prothoracic tibia in *Timora* and a number of species of *Canthylidia* has one or a pair of subequal apical modified spines. In *Masalia* and *Timora* the prothoracic tibia is otherwise unspined. In *Canthylidia* there is often one modified spine, but this may be absent. In *Adisura* the prothoracic tibia is devoid of modified spines, but other spines are usually present. In all four genera the proboscis is short; in *Masalia* and *Timora* the quotient is usually 2–3; in *Adisura* and *Canthylidia* usually between 3 and 4.

Masalia is distributed across Africa, the Malagasy Republic, Saudi Arabia, southern Iran, West and East Pakistan, India, Ceylon, China, Lombok, Flores, and northern Australia.

GROUPS WITHIN THE GENUS. Although there is much structural uniformity within the genus, differences in wing pattern and colouring are quite marked. Shared and differing characters are met with in an assortment of combinations. A number of species-groups are recognized, but it is not suggested that they are entirely natural, for some of the characters used may well be affected by parallel evolution.

The *fissifascia*-group. Two species, *philbyi* and *fissifascia*, characterized by a white, distally forked, lower central longitudinal streak on the fore wing (Text-fig. 4). Distribution: East Africa, Saudi Arabia, southern Iran and Afghanistan.

The *decorata*-group. The species are *decorata*, *leucostica*, *funebris*, *prochaskai* and *sublimus*; fore wing with transverse rather than longitudinal markings and with

pink (or red) and yellow colouring (Text-fig. 11). Distribution: Africa, Malagasy Republic, Afghanistan, India and Ceylon.

The *galatheae*-group. The species are *distincta, cruentata* and *galatheae* (the latter two being regarded as a species-complex); fore wing with the costal and anal regions pink, and central region white to yellowish white. Although their fore wings are white, *flaviceps* and *hololeuca* are also included. In a few specimens of *flaviceps*, almost imperceptible demarcation between the costal, central and anal regions can be traced, revealing the pattern found in *galatheae*. *M. hololeuca* and *M. flaviceps* are the only species within the genus having white fore wings. Distribution: Africa, India and China.

The *radiata*-group. The species are *radiata, rubristria, beatrix, epimethea, rosacea, roseivena* and *flavistrigata*; fore wing with the costal and anal regions, and parts of central region, reddish brown to brown, with a yellowish white, upper central longitudinal streak and usually with an anal streak of the same colour. Distribution: Africa, Malagasy Republic, India, Lombok, Flores and northern Australia.

M. latinigra and *M. cheesmanae* are regarded as a species complex characterized by a single modified spine on the prothoracic tibia. Distribution: Africa.

M. albida, with its long proboscis (proboscis quotient 6) and distinctive pattern, and *M. perstriata*, also with a long proboscis and node-like distension of the costa of the fore wing (Text-fig. 10), are species distinct from each other and from others within the genus.

The remaining species do not fit into convenient groupings.

DISTRIBUTION. The genus is predominantly Afro-Indian. Of the 38 species, 15 are African endemics and 15 endemic to India (one extending northwestward into China). A further four species occur both in Africa and India (one also occurring in Ceylon). Of the remaining four, three occur in the Malagasy Republic, the fourth being found in northern Australia and the islands Lombok and Flores, near northern Australia.

KEY TO THE SPECIES AND SUBSPECIES

The taxonomic features of the Heliothidinae suggest that a large number of species have undergone recent speciation. There is a high degree of structural uniformity within the subfamily, and marked superficial variation within species; the species are separated by only slight discontinuities. The key has been constructed as far as possible on the basis of non-sexual characters, but the use of the papilla analis of the female and, less often, the aedeagus and antennae of the male has been unavoidable in some couplets. Because of the limited number of structural characters, pattern and colour have been widely used.

1	Fore wing upper surface with a white to yellowish white upper central longitudinal streak as in Text-fig. 2 or with a forked lower central longitudinal streak as in Text-fig. 4	2
–	Fore wing upper surface without a white upper, or forked lower, central longitudinal streak	22

2 (1) Fore wing upper surface with a white forked lower central longitudinal streak (following Cu_1 and dividing with it along M_3–Cu_{1a}) 3

– Fore wing upper surface without a white forked lower central longitudinal streak 5

3 (2) Fore wing upper surface light yellow to brownish orange. (Arabian, Iranian or Afghanistan species) . . . . . . ***M. philbyi*** (Brandt) (p. 19)

– Fore wing upper surface greyish red. (East African species) 4

4 (3) Fore wing upper surface with the white forked streak outlined with light brown. ***M. fissifascia fissifascia*** (Hampson) (p. 23)

– Fore wing upper surface with the white forked streak not outlined with light brown . . . . ***M. fissifascia roseata*** (Pinhey) (p. 24)

5 (2) Fore wing with areole 6

– Fore wing without areole 18

6 (5) Madagascan, African, Arabian or Iranian species. 7

– Indian species 13

7 (6) Madagascan species.
Fore wing with pointed apex (Text-fig. 23); upper surface brownish orange, costal margin white . . . . . ***M. epimethea*** (Viette) (p. 61)

– African, Arabian or Iranian species 8

8 (7) Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 9

– Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19) 12

9 (8) Fore wing upper surface with costal region pastel to greyish red; central region white, with a dark brown to black, lower central longitudinal streak, and a faint to well developed dark brown to black streak between R_5 and M_1 (Pl. 6, figs 177, 178) . . . . ***M. beatrix trifasciata*** (Hampson) (p. 61)

– Fore wing upper surface with costal region pale yellow to greyish orange . 10

10 (9) Abdomen with posterior margin of 8th tergum ridged and centrally emarginate (Text-fig. 20).
Fore wing upper surface with a white anal longitudinal streak and with faint to well developed white streaks between M_2 and M_3, between M_3 and Cu_{1a}, and between Cu_{1a} and Cu_{1b} (Pl. 10, figs 223, 224). ***M. albida*** (Hampson) (p. 93)

– Abdomen with posterior margin of 8th tergum not ridged; straight or centrally only slightly emarginate (Text-fig. 21) 11

11 (10) Hind wing upper surface light to yellowish brown. ***M. rubristria rhodomelaleuca*** (Berio) (p. 58)

– Hind wing upper surface white. ***M. perstriata fuscostriata*** (Brandt) (part) (p. 96)

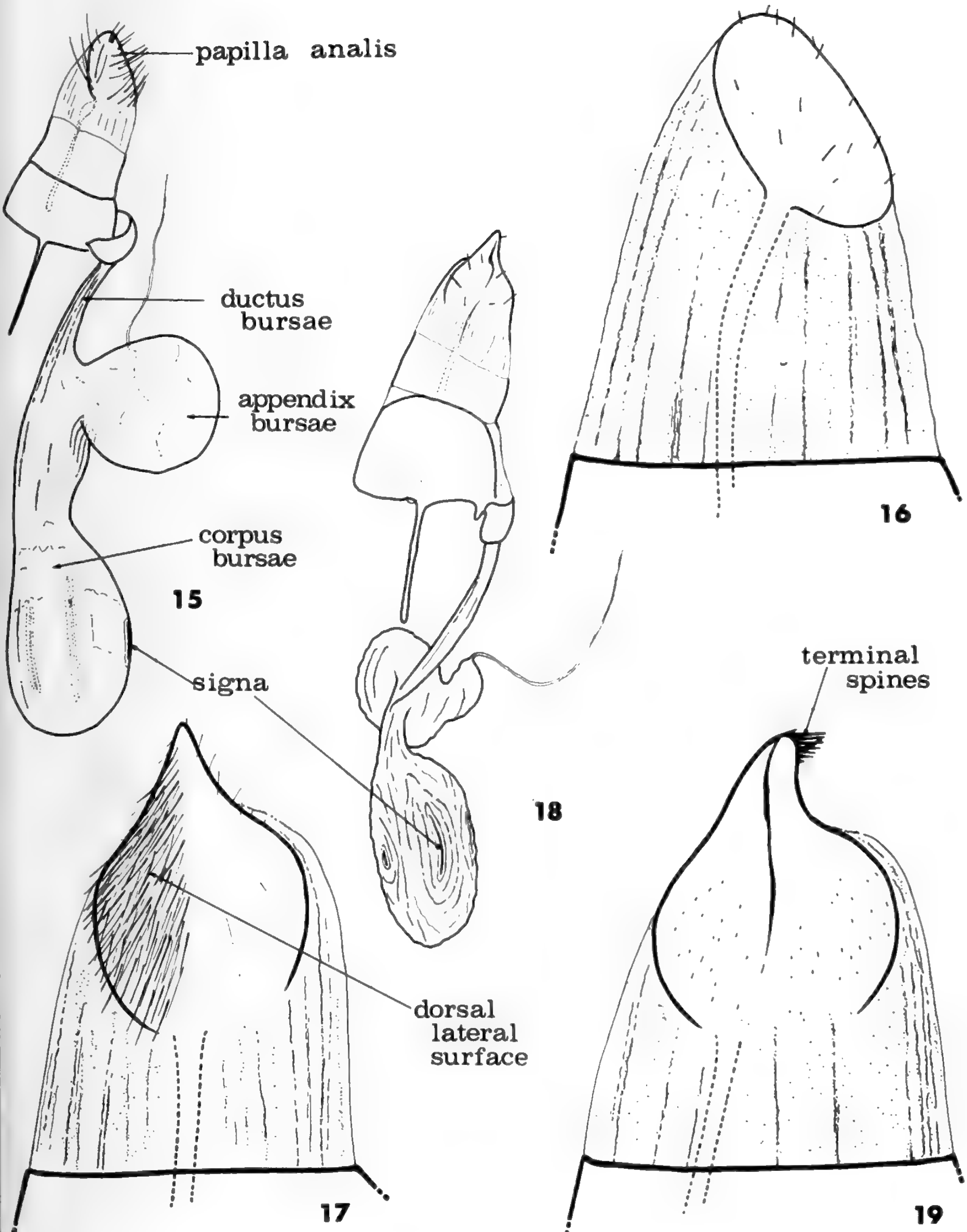
12 (8) Fore wing apex rounded (Text-fig. 22). Female genitalia with surface of papilla analis spiculate (striate appearance); dorso-laterally not sericate, as in Text-fig. 86 . . . . . . ***M. terracottoides*** (Rothschild) (p. 75)

– Fore wing apex pointed (Text-fig. 23). Female genitalia with surface of papilla analis not spiculate but dorso-laterally sericate, as in Text-fig. 72. ***M. flavistrigata*** (Hampson) (part) (p. 65)

13 (7) Australian species.
Fore wing upper surface with a pink (or pink suffused with reddish brown) lower central longitudinal streak; costal and anal regions pink, central region white . . . . ***M. roseivena*** (Walker) (p. 63)

Indian species 14

14 (13) Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 15



FIGS 15–19. Structures of female genitalia of *Masalia*. 15 and 16, papilla analis simple (membranous and rounded). 17–19, papilla analis modified (sclerotized).

– Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded, or digitate) (Text-figs 17, 18, 19) 16

15 (14) Female genitalia with papilla analis of right-angle triangular shape (Text-fig. 93). Fore wing upper surface light greyish or brownish orange; marginal cilia with banded appearance, proximally brownish orange, distally white, colour separated by a well defined line as in Pl. 8, figs 208, 209.
M. tosta Moore (part) (p. 80)

– Female genitalia with papilla analis not of right-angle triangular shape. Fore wing upper surface with costal, central and anal regions light orange to pastel-red or with central region white with light red to pastel-red streaks.
M. beatrix beatrix (Moore) (part) (p. 59)

16 (14) Fore wing upper surface pinkish white. Female genitalia with terminal spines on the papilla analis (Text-fig. 19).
Hind wing upper surface reddish golden brownish orange.
M. rosacea Hampson (p. 62)

– Fore wing upper surface pale yellow, light to brownish orange or light brown. Female genitalia without terminal spines on the papilla analis (Text-fig. 18) 17

17 (16) Hind wing upper surface either white or greyish to brownish orange.
M. radiata terracotta Hampson (part) (p. 52)

– Hind wing upper surface brown . . . ***M. radiata radiata*** Moore (p. 52)

18 (5) African species 19

– Indian species.
Fore wing upper surface pale yellow or light to brownish orange. Hind wing upper surface white or greyish to brownish orange.
M. radiata terracotta Hampson (part) (p. 52)

19 (18) Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 20

– Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19) 21

20 (19) Fore wing upper surface with greyish rose, light brown, brown or reddish brown markings. (West Africa) ***M. rubristria rubristria*** (Hampson) (p. 54)

– Fore wing upper surface with pale to pastel or greyish red markings. (Central, East and southern Africa) . ***M. rubristria transvaalica*** (Distant) (p. 57)

21 (19) Male genitalia with cornutus . ***M. bimaculata cornia*** subsp. n. (part) (p. 90)

– Male genitalia without cornutus.
M. bimaculata pluritelifora (Berio) (part) (p. 90)

22 (1) Prothoracic tibia with a single terminal modified spine (Text-fig. 74) . . 23

– Prothoracic tibia with a pair of terminal modified spines (Text-fig. 6) . . 27

23 (22) Fore wing with rounded apex (Text-fig. 22). Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 24

– Fore wing with pointed apex (Text-fig. 23). Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19) . . . ***M. flavistrigata*** (Hampson) (part) (p. 65)

24 (23) Fore wing upper surface with a distinct broad, dark brown to black lower central longitudinal streak . . ***M. latinigra latinigra*** (Hampson) (p. 68)

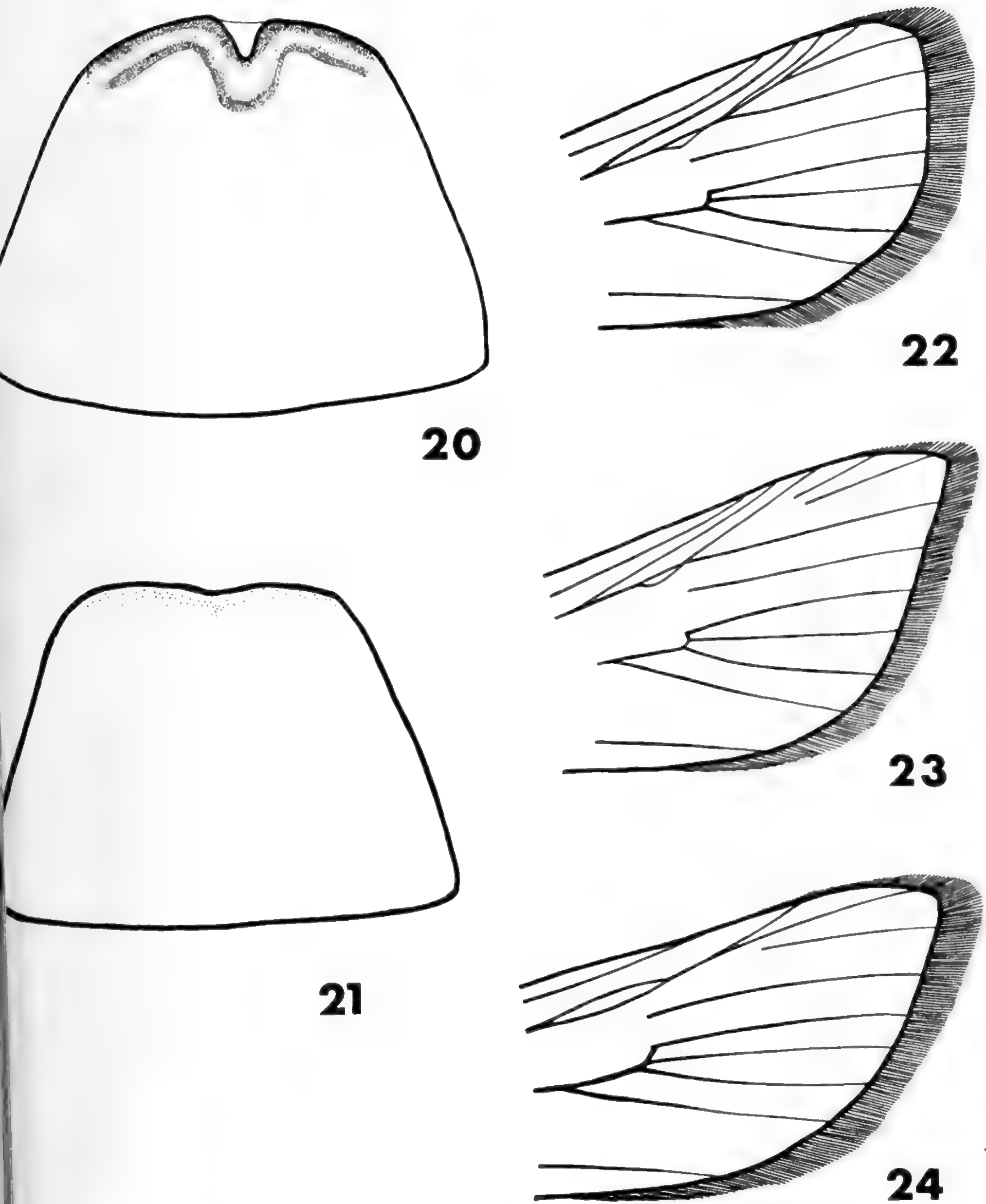
– Fore wing upper surface with at most an indistinct narrow lower central longitudinal streak. 25

25 (24) Hind wing with upper surface white to orange-white.
M. cheesmanae cheesmanae subsp. n. (p. 69)

– Hind wing upper surface brownish orange to brown 26

26 (25) Male antenna with simple flagellar segments (Text-fig. 79). (Known only from southern Sudan) . . . ***M. cheesmanae tamburensis*** subsp. n. (p. 70)

– Male antenna with lamellate flagellar segments (Text-fig. 77). (Known only from Ethiopia) . . . . ***M. latinigra dangilensis*** subsp. n. (p. 69)



FIGS 20–24. Structures of *Masalia*. 20 and 21, 8th abdominal terga, dorsal view. 22–24, fore wing apices rounded (22) and pointed (23) and (24).

27 (22) Fore wing upper surface with a series of white postmedial dots or dashes (Text-figs 32, 33) 28
– Fore wing upper surface without a series of white postmedial dots or dashes . 36
28 (27) Fore wing upper surface from light to greyish yellow with distinct pink to red markings 29
– Fore wing upper surface not of this colour and pattern; if the colour of the fore wing upper surface is yellow and greyish red (variety of *M. quilengesi*), the yellow merges almost imperceptibly into the greyish red. 35
29 (28) Fore wing upper surface with the proximal half of the costal region pink to red as in Pl. 2, fig. 129, or light to greyish yellow, traversed by a pink to red longitudinal streak as in Pl. 2, fig. 127 30
– Fore wing upper surface with the proximal half of the costal region light to greyish yellow, not traversed by a pink to red longitudinal streak as in Pl. 1, fig. 124 33
30 (29) African species
– Madagascan species.
Fore wing upper surface with a wide pink longitudinal band occupying nearly the whole costal region (Pl. 2, fig. 132) ***M. prochaskai*** (Viette) (part.) (p. 34)
31 (30) Fore wing upper surface with the post- and antemedial pink markings contiguous, as in Pl. 2, figs 129, 130 32
– Fore wing upper surface with the post- and antemedial pink markings not contiguous, as in Pl. 2, fig. 127 ***M. leucosticta leucosticta*** (Hampson) (p. 30)
32 (31) From northern Tanzania, Kenya, Ethiopia or Somalia. Fore wing usually with areole . . . . ***M. leucosticta vinula*** (Berio) (p. 32)
– From southern Tanzania or southern Congo (Kinshasa). Fore wing without areole. . . . . . . ***M. leucosticta joiceyi*** (Prout) (p. 33)
33 (29) From Africa or Arabia 34
– From India.
Male genitalia with scobinate bar and cornutus (Text-fig. 34).
M. decorata decorata (Moore) (p. 25)
34 (33) Fore wing upper surface with post medial dots arranged more or less centrally within the pink to red postmedial band (Text-fig. 32).
M. decorata metarhoda (Druce) (p. 27)
– Fore wing upper surface with postmedial dots arranged along the inner margin of the pink to red postmedial band (Text-fig. 33).
M. decorata albiseriata (Druce) (p. 27)
35 (28) Fore wing upper surface with the costal and central regions bluish red, anal region brown. Hind wing upper surface brown . ***M. funebris*** (Berio) (p. 33)
– Fore wing upper surface light yellow suffused with pastel-red. Hind wing upper surface pale yellow . . . . ***M. quilengesi*** sp. n. (part) (p. 74)
36 (27) Fore wing upper surface with white orbicular and discocellular dots (Text-fig. 25) 37
– Fore wing upper surface without white orbicular and discocellular dots . . 39
37 (36) Fore wing upper surface with anal region pink 38
– Fore wing upper surface with anal region yellowish white.
M. disticta albirosea (de Joannis) (p. 38)
38 (37) Fore wing upper surface with central region yellowish white (Pl. 2, fig. 136).
M. disticta disticta (Hampson) (p. 36)
– Fore wing upper surface with central region pink, apart from a pale yellow basal dash (Pl. 2, fig. 137) . . . . ***M. disticta flavirosea*** (Hampson) (p. 39)
39 (36) Fore wing upper surface white or with costal and anal regions yellowish white and central region white 40
– Fore wing upper surface not as above 41
40 (39) Fore wing with areole. (Indian species) . . ***M. hololeuca*** (Hampson) (p. 50)

– Fore wing without areole. (African species) . ***M. flaviceps*** (Hampson) (p. 49)

41 (39) Fore wing upper surface with costal region white, white with margin pink, pale to light yellow, or pink to dull red; central region white or pale to light yellow; anal region light yellow or pink to dull red. Costal and anal regions, or anal region only, of darker colour than central region; otherwise immaculate (Pl. 3, figs 138 to 147 and Pl. 4, figs 150 to 152) 42

– Fore wing upper surface not as above 45

42 (41) Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19) 43

– Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) . ***M. galatheae bechuana*** subsp. n. (part) (p. 46)

43 (42) Fore wing upper surface with costal region pink 44

– Fore wing upper surface with costal region white, either immaculate or with costal margin pink . . . . . ***M. cruentata*** (Moore) (part) (p. 47)

44 (43) Female genitalia without terminal spines on the papilla analis (Text-fig. 52). (From north India, Nepal, Tibet or China) ***M. cruentata*** (Moore) (part) (p. 47)

– Female genitalia with terminal spines on the papilla analis (Text-figs 46 to 49). (From India or Africa) . . . ***M. galatheae galatheae*** (Wallengren) (p. 40)

45 (41) Fore wing with areole 46

– Fore wing without areole 63

46 (45) Madagascan, African, Arabian or Iranian species 47

– Indian species 56

47 (46) Madagascan species.

Fore wing upper surface light yellow with a wide pink longitudinal band occupying nearly the whole costal region (Pl. 2, fig. 132).

M. prochaskai (Viette) (part) (p. 34)

– African, Arabian or Iranian species 48

48 (47) Fore wing upper surface with a light to dark brown lower central longitudinal streak, sometimes distad-splayed (Pl. 9, fig. 218 and Pl. 10, fig. 226) . . 49

– Fore wing upper surface without a light to dark brown lower central longitudinal streak 51

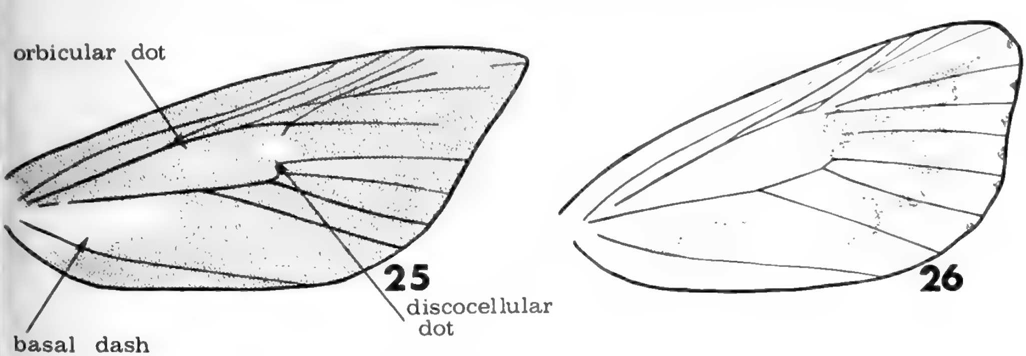
49 (48) Fore wing upper surface with a brown discocellular spot as in Pl. 9, fig. 218.

M. bimaculata nigrifasciata (Hampson) (part) (p. 87)

– Fore wing upper surface without a discocellular spot 50

50 (49) Fore wing upper surface with brown postmedial and terminal dots (Pl. 10, fig. 230) . . . . . . ***M. perstriata zernytamsia*** (Berio) (p. 96)

– Fore wing upper surface with or without brown postmedial dots; brown terminal dots absent . . ***M. perstriata fuscostriata*** (Brandt) (part) (p. 96)



FIGS 25–26. Fore wing markings of *Masalia disticta* (25) and *M. albipuncta* (26)

51 (48) Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 52

– Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19).
Fore wing upper surface from pale to greyish orange, or pastel red through brownish orange to dull red. Anal region immaculate or lightly suffused with greyish brown (Pl. 7, fig. 187) . ***M. flavistrigata*** (Hampson) (part) (p. 65)

52 (51) Female genitalia with the surface of the papilla analis spiculate (striate appearance) (Text-fig. 89).
Fore wing upper surface orange with light brown to brown markings.
M. nubila (Hampson) (p. 77)

– Female genitalia with the surface of the papilla analis not spiculate . . 53

53 (52) Hind wing upper surface light brown to brown.
Fore wing upper surface light orange irregularly irrorate with brown.
M. mittoni (Pinhey) (p. 82)

– Hind wing upper surface yellowish white 54

54 (53) Fore wing upper surface with costal and anal regions light yellow or dull red to greyish pink; central region pale yellow, irrorate with dark brown between veins, as in Pl. 3, figs 148, 149 ***M. galatheae bechuana*** subsp. n. (part) (p. 46)

– Fore wing upper surface not of this colour and pattern 55

55 (54) Fore wing upper surface with an oblique to longitudinal reddish brown to brown dash near the base of the anal region (Text-fig. 26).
M. albipuncta (Hampson) (p. 73)

– Fore wing upper surface without an oblique to longitudinal reddish brown to brown dash near the base of the anal region ***M. quilengesi*** sp. n. (part) (p. 74)

56 (46) Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19) 57

– Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 58

57 (56) Fore wing upper surface orange or greyish orange marked with brownish orange. Female genitalia with the dorso-lateral surface of the papilla analis not sericate (Text-fig. 91) . . . . . . ***M. dora*** Swinhoe (p. 78)

– Fore wing upper surface yellowish white to pale orange, often finely irrorate with brown (a brown discocellular spot and brown central longitudinal streak may be present). Female genitalia with the dorso-lateral surface of the papilla analis sericate (Text-fig. 104) . . ***M. bimaculata bimaculata*** (Moore) (p. 87)

58 (56) Female genitalia with papilla analis of right-angle triangular shape (Text-fig. 93).
Fore wing upper surface either light greyish or brownish orange.
M. tosta Moore (part) (p. 80)

– Female genitalia with papilla analis not of right-angle triangular shape . . 59

59 (58) Fore wing upper surface yellowish white to pale yellow with a series of brown postmedial and terminal dots and a poorly differentiated brown lower central longitudinal streak . . ***M. perstriata perstriata*** (Hampson) (p. 94)

– Fore wing upper surface not marked in this way 60

60 (59) Fore wing upper surface with the costal and anal regions light orange to pastel-red; central region yellowish white to pale yellow, streaked with light orange or pastel-red (a light brown to brown lower central longitudinal streak may also be present) . . ***M. beatrix beatrix*** (Moore) (part) (p. 59)

– Fore wing upper surface with the costal, central and anal regions either pale light yellow or greyish orange 61

61 (60) Hind wing upper surface yellowish white with proximad light brown suffusion.
M. semifusca sp. n. (p. 79)

– Hind wing upper surface concolorous 62

62 (61) Male genitalia with 40 or more closely packed spicules on the scobinate bar. (Text-fig. 99) . . . . **M. modesta** (Moore) (p. 84)

– Male genitalia with 20 or fewer sparsely scattered spicules on the scobinate bar (Text-fig. 95) . . . . . . **M. artaxoides** (Moore) (part) (p. 81)

63 (45) African species 64

– Indian species 69

64 (63) Fore wing upper surface pastel yellow with a greyish pink to dull red oblique dash extending from the apex to the central region (Pl. 2, figs 133, 134). **M. sublimis** (Berio) (p. 35)

– Fore wing upper surface not of this colour and pattern 65

65 (64) Fore wing upper surface with a brown to dark brown lower central longitudinal streak (Text-fig. 3) 66

– Fore wing upper surface without a brown to dark brown lower central longitudinal streak 67

66 (65) Fore wing upper surface with the costal and anal regions pale to dull red; central region yellowish white to light yellow with the red colouring occasionally extending in from the costal and/or anal region; with or without brown irroration . . . **M. bimaculata nigrifasciata** (Hampson) (p. 87)

– Fore wing upper surface with the costal, central and anal regions white, pale yellow, greyish orange or reddish grey, irrorate with brown. **M. bimaculata cornia** subsp. n. (part) (p. 90)

67 (65) Female genitalia with terminal spines on the papilla analis (Text-fig. 19). Fore wing upper surface pale to greyish orange with a faint brown discocellular spot. . . . . **M. flavocarnea** (Hampson) (p. 92)

– Female genitalia without terminal spines on the papilla analis 68

68 (67) Male genitalia with a cornutus. Fore wing upper surface yellowish white to pale or greyish orange . . **M. bimaculata cornia** subsp. n. (part) (p. 90)

– Male genitalia without a cornutus. Fore wing upper surface greyish orange, greyish red, pale red, or reddish grey. **M. bimaculata pluritelifora** (Berio) (part) (p. 90)

69 (63) Fore wing upper surface with brown postmedial streaks on veins M_1 to Cu_{1a}, as in Pl. 7, fig. 195 . . . . **M. uncta** (Swinhoe) (p. 70)

– Fore wing upper surface without brown postmedial streaks on veins M_1 to Cu_{1a}. 70

70 (69) Female genitalia with modified papilla analis (sclerotized and of variable shape, rounded, folded or digitate) (Text-figs 17, 18, 19). Fore wing upper surface brownish orange; anal region irrorate with brown, otherwise immaculate . . . . . . **M. metaphaea** (Hampson) (p. 82)

– Female genitalia with unmodified papilla analis (membranous and of rounded shape) (Text-figs 15, 16) 71

71 (70) Fore wing upper surface bicolorous, light yellow with a brownish outer margin. **M. albicilia** (Hampson) (p. 72)

– Fore wing upper surface concolorous, light yellow or greyish orange. **M. artaxoides** (Moore) (part) (p. 81)

DESCRIPTIONS OF THE SPECIES AND SUBSPECIES

Masalia philbyi (Brandt) comb. n.

(Text-figs 27–29; Pl. 1, figs 114–117; Map 1)

Timora philbyi Brandt, 1941 : 853. LECTOTYPE ♂, IRAN (NR, Stockholm), here designated [examined.].

Timora philbyi nuristana Boursin, 1960 : 151. Holotype ♀, AFGHANISTAN (ZSBS, Munich) [examined]. **Syn. n.**

Timora philbyi arabica Boursin, 1960 : 152. Holotype ♂, SAUDI ARABIA (ZSBS, Munich) [examined]. **Syn. n.**

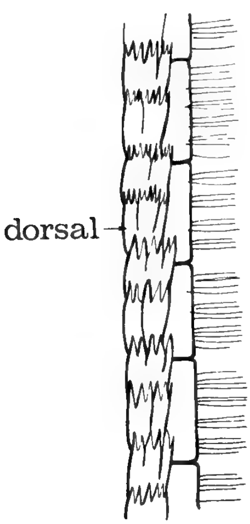
Antenna with flagellar segments sexually dimorphic (Text-figs 27, 28). Proboscis quotient 4 to 5. Fore wing with areole; length, ♂ (21), 13·9–17·6 (lectotype 16·6), ♀ (18), 14·4–18·3. Wing-pattern as in Pl. 1, figs 114–117. Fore wing upper surface with ground colour light yellow to brownish orange; longitudinal streaks white, either faint or distinctly outlined with brownish orange or light brown. Hind wing upper surface white, immaculate or irrorate with brownish orange.

Genitalia. ♂ scobinate bar and cornutus as in *M. fissifascia* (Text-fig. 31). ♀ papilla analis finely spiculate, but simple (Text-fig. 29).

MATERIAL EXAMINED.

Timora philbyi, LECTOTYPE, here designated, IRAN: Laristan, Strasse Bender-Abbas-Sardabad Sardze, about 200 m, ♂, xi(mid).1937 (*Brandt*), in NR, Stockholm; paralectotype, IRAN: Baloutchistan, Strasse Tchahbahar–Iranchar, Tahte-Malek, 750 m, ♂, iv(early).1938 (*Brandt*), in NR, Stockholm. *Timora philbyi nuristana*, holotype, AFGHANISTAN: Asmar, Kunartal, 900 m, ♀, 3.iv.1953, in ZSBS, Munich. *Timora philbyi arabica*, holotype, SAUDI ARABIA: El Riad, ♂, 6.iii.1958 (*E. Diehl*), in ZSBS, Munich; paratype, SAUDI ARABIA: El Riad, ♀, 11.iii.1958 (*E. Diehl*), in ZSBS, Munich.

SAUDI ARABIA: Buraiman, 1 ♀ (*Wiltshire*); Dawadami, 1 ♂, 2 ♀, 8.iii.1935; Jidda, 1 ♀, 13.ii.1929; 2 ♀, 28–31.i.1930; 1 ♂, 1 ♀, 26.xii.1934; Khafs, 1 ♀, 26.ii.1935; Marrat, 3 ♂, 6.iii.1935; Mecca, 1 ♂, 7.xii.1934; 1 ♀, 15.ii.1934; Shaib Sudair, 1 ♂, 6.ii.1935; Sir, Khufuiflya, 2 ♂, 7.iii.1935; Usba, 3 ♂, 1 ♀, 5.iii.1935 (all coll. *H. St. J. B. Philby*); E. Ryadh, 1 ♂, 13.iii.1958 (*E. Diehl*), in ZSBS, Munich; AFGHANISTAN: Sarobi, 1100 m, 9 ♂, 2 ♀, 15.iv.–10.iv.1961 (*G. Ebert*), in ZSBS, Munich.



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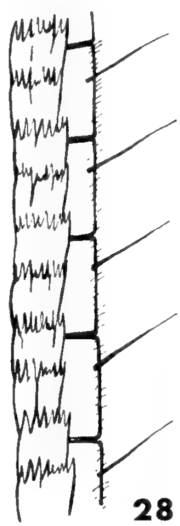

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FIGS 27–28. *M. philbyi*, antennal segments, lateral view. 27, ♂. 28, ♀.

Distribution (Map 1). Arabia, southern Iran and east Afghanistan.

Remarks. The species is readily distinguished from *M. fissifascia*, the only other species in the group, by the difference in fore wing colour, light yellow to brownish orange in *M. philbyi*, greyish red in *M. fissifascia*.

The type-specimens of *philbyi*, *nuristana* and *arabica*, differing slightly from one another in pattern and colour, lie within a range of continuous variation likely to be found in any one locality.

Masalia fissifascia (Hampson) comb. n.

(Text-figs 30, 31; Pl. 1, figs 118, 119; Map 1)

Timora fissifascia Hampson, 1903 : 110.

Antenna with flagellar segments sexually dimorphic, as in *philbyi* (Text-figs 27, 28). Proboscis atypically long, quotient 4 to 5. Fore wing with areole present.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 31; ♀ papilla analis finely spiculate, but simple (Text-fig. 30).

M. fissifascia can be separated from *M. philbyi*, the only other species within the group and the only one with which it is likely to be confused, on the difference in fore wing ground colour. In *M. fissifascia* the ground colour is greyish red, in

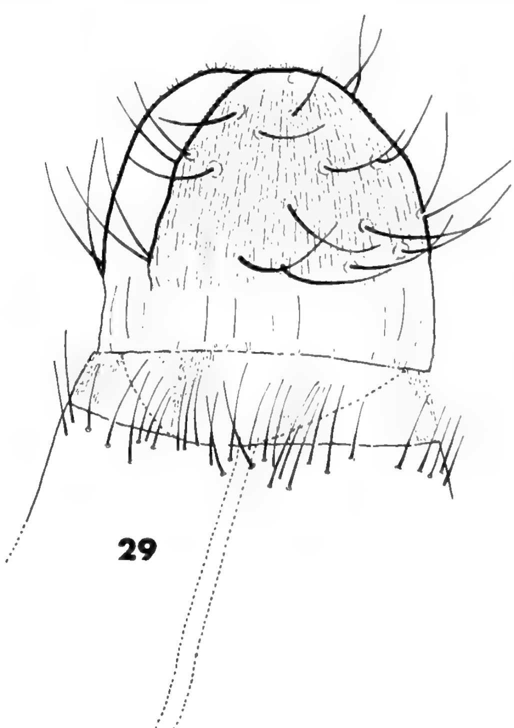

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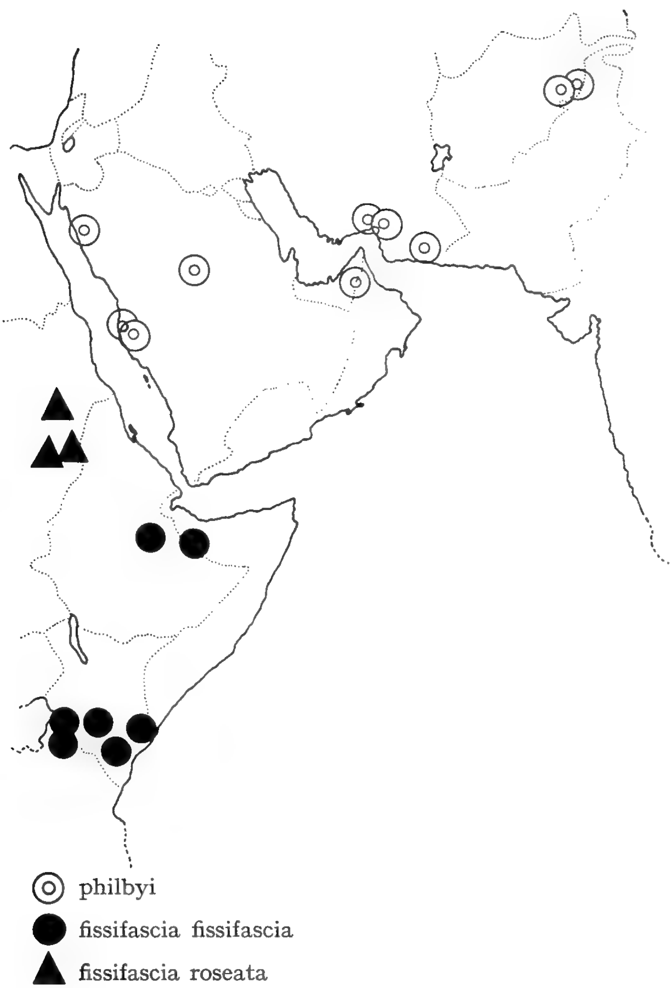
Fig. 29. *M. philbyi*, ♀, papilla analis.

M. philbyi light yellow to brownish orange. *M. fissifascia* is also smaller in size, though overall ranges of the species overlap. Two subspecies are recognized, *M. f. fissifascia* from Ethiopia, Somali Republic and Kenya, and *M. f. roseata* from Sudan. Subspecies *fissifascia* can be separated from *roseata* on the light brown outlining of the forked, lower central longitudinal streak, absent in *roseata*.



MAP 1. Distribution of species and subspecies of the *fissifascia*-group.

Masalia fissifascia fissifascia (Hampson)

(Pl. 1, fig. 118; Map 1)

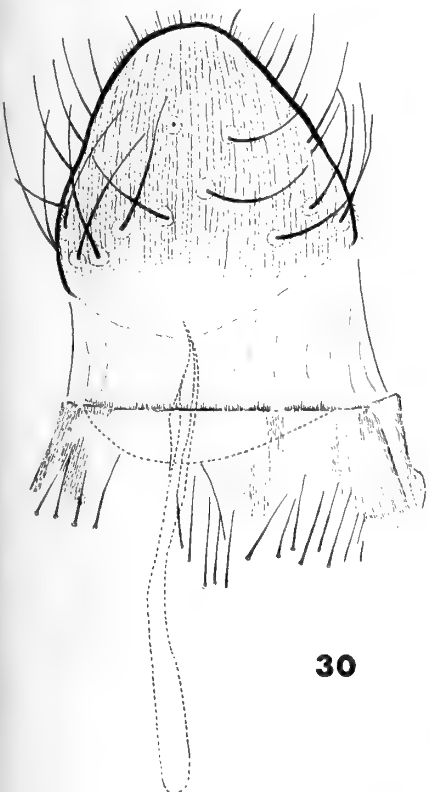
Timora fissifascia Hampson, 1903 : 110. Holotype ♂, KENYA (BMNH) [examined].

Fore wing length ♂ (5), 12·4–13·3 (holotype 13·3), ♀ (6), 16·6–15·1. Wing pattern as in Pl. 1, fig. 118. Fore wing upper surface with ground colour greyish red; radial streaks, lower central longitudinal streak and anal longitudinal streak white, outlined with light brown. The white in the anal longitudinal streak is occasionally missing but more often represented by a short proximal line. Hind wing upper surface white, immaculate or irrorated with light brown.

MATERIAL EXAMINED.

Holotype, [KENYA] B.E. Africa: [Kibaoni] Kibauni, ♂ 4.xii.1898 (*R. Crawshay*).

ETHIOPIA: Dire Daoua, 1 ♂, ix.1935 (*H. Uhlenhuth*); SOMALI REPUBLIC: Buran, 10°13′N, 48°47′E, 3000 ft, 1 ♀, ix–x.1929 (*C. L. Collenette*); Hargeisa, 4300 ft, 1 ♂, 1 ♀, v.1929 (*M. Portal-Hyatt*); KENYA: Kedai: 1 ♀, xii.1911 (*Feather*); Kibwezi, 1 ♀, xii.1921 (*Feather*); Nairobi, 1 ♂, iv.1927 (*D. H. Hopkins*); South Kavirondo, Suna, 2 ♂, 1 ♀, iii–iv.1932 (*W. Feather*).



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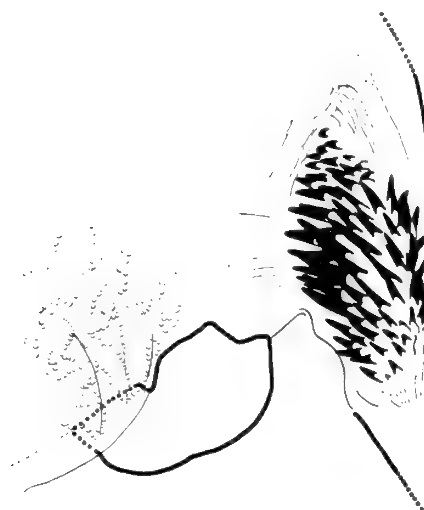

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FIGS 30–31. *M. fissifascia*, genitalia. 30, ♀. 31, ♂.

DISTRIBUTION (Map 1). Ethiopia, Somali Republic and Kenya.

REMARKS: The light brown outlining of the forked lower central longitudinal streak separates subspecies *fissifascia* from *roseata*.

Masalia fissifascia roseata (Pinhey) **comb. et stat. n.**

(Pl. 1, fig. 119; Map 1)

Timora roseata Pinhey, 1956 : 13. Holotype ♂, SUDAN (BMNH) [examined].

Forewing length ♂ (2), 13·2–14·0 (holotype), ♀ (2), 12·3–13·2. Wing pattern as in Pl. 1, fig. 119. Fore wing upper surface with ground colour pale to greyish red, longitudinal streaks white. Hind wing upper surface white.

MATERIAL EXAMINED.

Holotype, SUDAN: Showak, ♂, ix.1949 (*E. Wilson*). Paratype, SUDAN: Showak, ♀, ix.1949 (*E. Wilson*).

SUDAN: Ed Damer, Hudeiba, 1 ♂, 8.viii.1962 (*R. Remane*), in ZSBS, Munich; Blue Nile Province, Wad Medani, 1 ♂, 2.viii.1962 (*R. Remane*), in ZSBS, Munich.

DISTRIBUTION (Map 1). North-east Sudan.

REMARKS. The absence from *M. f. roseata* of brown outlining to the longitudinal streaks distinguishes it from the nominate subspecies.

Masalia decorata (Moore) **comb. n.**

(Text-figs 32–36; Pl. 1, figs 120–125; Map 2)

Pradatta decorata Moore, 1881 : 365.

M. decorata is closely allied to *M. leucosticta*. The absence from *M. decorata* of pink in the proximal to mid costal region of the fore wing distinguishes it from *M. leucosticta*.

Three subspecies are recognized, *M. d. decorata* from Afghanistan, India and Ceylon, *M. d. metarhoda* from Africa and *M. d. albiseriata* from Africa and Saudi Arabia. The subspecies are separable on the following genitalic differences in the male.

	cornutus of aedeagus	scobinate bar of aedeagus
M. d. decorata	present	present
M. d. albiseriata	absent	present
M. d. metarhoda	present	absent, or if present poorly differentiated

In addition the two African subspecies can be separated on differences in fore wing pattern and hind wing colour. The fore wing postmedial white dots or dashes in *M. d. albiseriata* lie along the proximal margin of the postmedial band (Text-fig. 33) whilst in *M. d. metarhoda* they lie more-or-less centrally within it (Text-fig. 32). In *M. d. albiseriata* the hind wing upper surface is white to light yellow, in *M. d.*

metarhoda greyish red, or greyish to brownish orange. Position of the postmedial white dots in *M. d. decorata* is variable, ranging from the condition found in *M. d. albiseriata* to that in *M. d. metarhoda*.

The possibility that *M. d. albiseriata* and *M. d. metarhoda* are biologically isolated is raised by the distribution of *M. d. albiseriata* and *M. d. metarhoda* in the Senegal–Gambia region, particularly the record of *M. d. albiseriata* and *M. d. metarhoda* from Dakar, caught on the same day, for no intermediate material was included. Their occurrence together cannot be satisfactorily explained, and more material and breeding experiments are needed to resolve the problem. However if *M. d. albiseriata* and *M. d. metarhoda* are biologically isolated they may well be linked as subspecies through *M. d. decorata*. The closer affinities of *M. d. albiseriata* and *M. d. metarhoda* to *M. d. decorata*, than to each other and their geographical isolation from *M. d. decorata* suggests an instance of a 'ring of races'.

Masalia decorata decorata (Moore)

(Text-fig. 34; Pl. 1, figs 120–122; Map 2)

Pradatta decorata Moore, 1881 : 365. Lectotype ♂, INDIA (BMNH) [examined].
Timora decorata (Moore) Hampson, 1903 : 106. [Lectotype designated.]

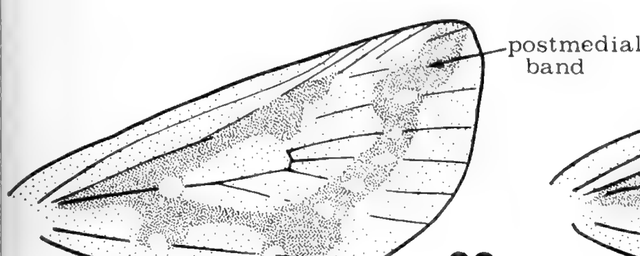
Fore wing with areole; length ♂ (57), 9·0–13·6 (lectotype 10·1), ♀ (22), 10·0–12·8. Wing pattern as in Pl. 1, figs 120–122. Fore wing upper surface with ground colour light yellow; transverse and longitudinal markings pastel-red to pink, antemedial dots, when present, and postmedial dots white. Hind wing upper surface white to pale yellow.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 34. ♀ papilla analis simple.

MATERIAL EXAMINED.

Lectotype, designated by Hampson, [INDIA: Uttar Pradesh,] Saidabad, ♂; paralectotypes, [Uttar Pradesh], Saidabad, 1 ♂ (*Atkinson*); [U.P.], Allahabad, 1 ♂ (*Hellard*); [U.P.] N.W. Provinces, [Mainpuri] Manpuri, 2 ♂, 1 ♀; Deccan, 1 ♀ (*Day*); [?]; Sind Valley, 1 ♂ (*Atkinson*), in MHNU, Berlin.

AFGHANISTAN: Bashgultal, 1300 m, 1 ♀, 15.vii.1952 (*J. Klapperich*); Sarobi, 1100 m, 1 ♀, 28.vi.1956 (*H. G. Amsel*), both in ZSBS, Munich. INDIA: Gujarat,



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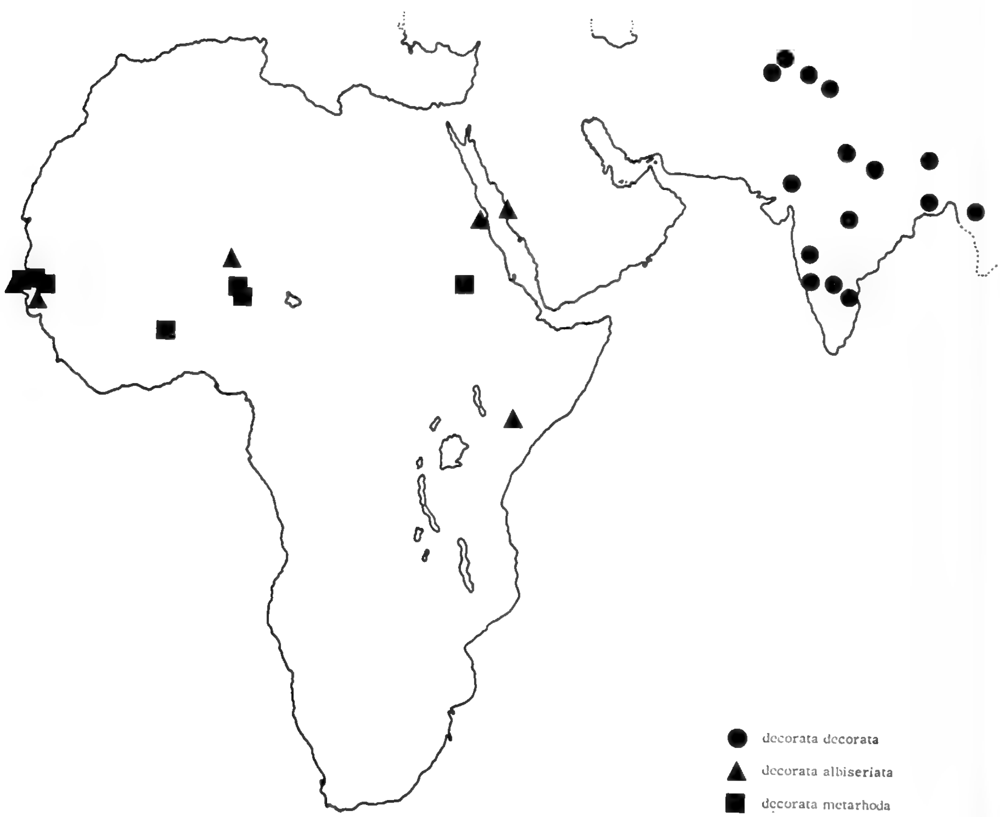
FIGS 32–33. 32, *M. decorata metarhoda*, fore wing. 33, *M. albiseriata* fore wing.

Deesa, 1 ♂, 1 ♀, viii.1890; 2 ♂, 1 ♀, x.1899; Himachal Pradesh, Dharmsala, 1 ♂; Jammu & Kashmir, Srinagar, 5200 ft, 1 ♀, vii.1892; 1 ♀, 3.viii.1892; 2 ♂, 6.viii.1892; 1 ♂, 10.viii.1892; 5 ♂, 1 ♀, 11.viii. 1892; 3 ♂, 1♀, 12.viii.1892; 1 ♂, 1 ♀, 14.viii.1892; 2 ♂, 1 ♀, x.1899; Maharashtra, Nagpur, 5 ♂; Mysore, Belgaum, 1 ♀ (*T. R. Bell*); Uttar Pradesh, Meerut, 1 ♀, 20.vii.1906 (*C. H. Ward*); West Bengal, Darjeeling, 1 ♂, (*Lidderdale*); W.B., Calcutta, 1 ♂, 1 ♀; ?, Umballa, 1 ♂, 21.ix.1903, (*C. H. Ward*). SIKKIM: 1 ♀. CEYLON: Kaits, 1 ♂, iii.1901; Puttalam, 7 ♂, 3 ♀; 6 ♂, 1 ♀. BURMA: 1 ♂.

DISTRIBUTION (Map 2). Afghanistan, India, Ceylon and Burma.

REMARKS. *M. d. decorata* can be separated from *M. d. albiseriata* and *M. d. metarhoda* on difference in male genitalia. In the nominate subspecies the cornutus and scobinate bar are both present, in *M. d. albiseriata* and *M. d. metarhoda* one or other of these structures is absent; in *albiseriata* the cornutus, in *metarhoda* the scobinate bar.



MAP 2. Distribution of subspecies of *M. decorata*.

Masalia decorata albiseriata (Druce) **comb. et stat. n.**

(Text-figs 33, 35; Pl. 1, fig. 123; Map 2)

Timora albiseriata Druce, 1903 : 200. LECTOTYPE ♂, GAMBIA (BMNH), here designated [examined].
Timora buchanani Rothschild, 1921 : 160. Holotype ♂, NIGER (BMNH) [examined]. **Syn. n.**

Fore wing with areole; length ♂ (9), 8·9–10·7 (lectotype 8·9), ♀ (10), 9·2–11·2. Wing pattern as in Pl. 1, fig. 123. Fore wing upper surface with ground colour light yellow; transverse and longitudinal markings pastel-red to pink; antemedial dots when present, and postmedial dots, white. Hind wing upper surface white to light yellow.

Genitalia. ♂ atypical in that the cornutus is absent; scobinate bar and proximal part of vesica as in Text-fig. 35; ♀ with papilla analis simple, as in *M. d. decorata*.

MATERIAL EXAMINED.

Timora albiseriata, LECTOTYPE, here designated, GAMBIA, ♂ (*A. Moloney*). Paralectotype, GAMBIA, ♀ (*A. Moloney*). *Timora buchanani*, holotype [NIGER:] Azzal, North of Agades, ♂, 14.vii.1920 (*A. Buchanan*). Paratypes. [NIGER:] Azzal, 1 ♀, 13.vii.1920; 1 ♂, 14.vii.1920; 2 ♂, 1 ♀, 15.vii.1920.

SENEGAL: Dakar, 1 ♂, 12.ix.1956 (*C. Rungs*), in MNHN, Paris; Kaolack, 2 ♀ (*LeMoult*). KENYA: Wajir, 1 ♀, iv.1958 (*Hutchinson*). [?]: Saloum, 1 ♂, v.1926. SAUDI ARABIA: Jidda, 1 ♀, 3.ii.1930; 1 ♀, 8.iv.1930; 1 ♂, 1 ♀, 26.v.1930 (all *H. St J. B. Philby*); Mujaririma, 1 ♂, 1 ♀, i.1945 (*B. P. Uvarov*).

DISTRIBUTION (Map 2). Senegal, Gambia, Ghana, Niger, Sudan and Saudi Arabia.

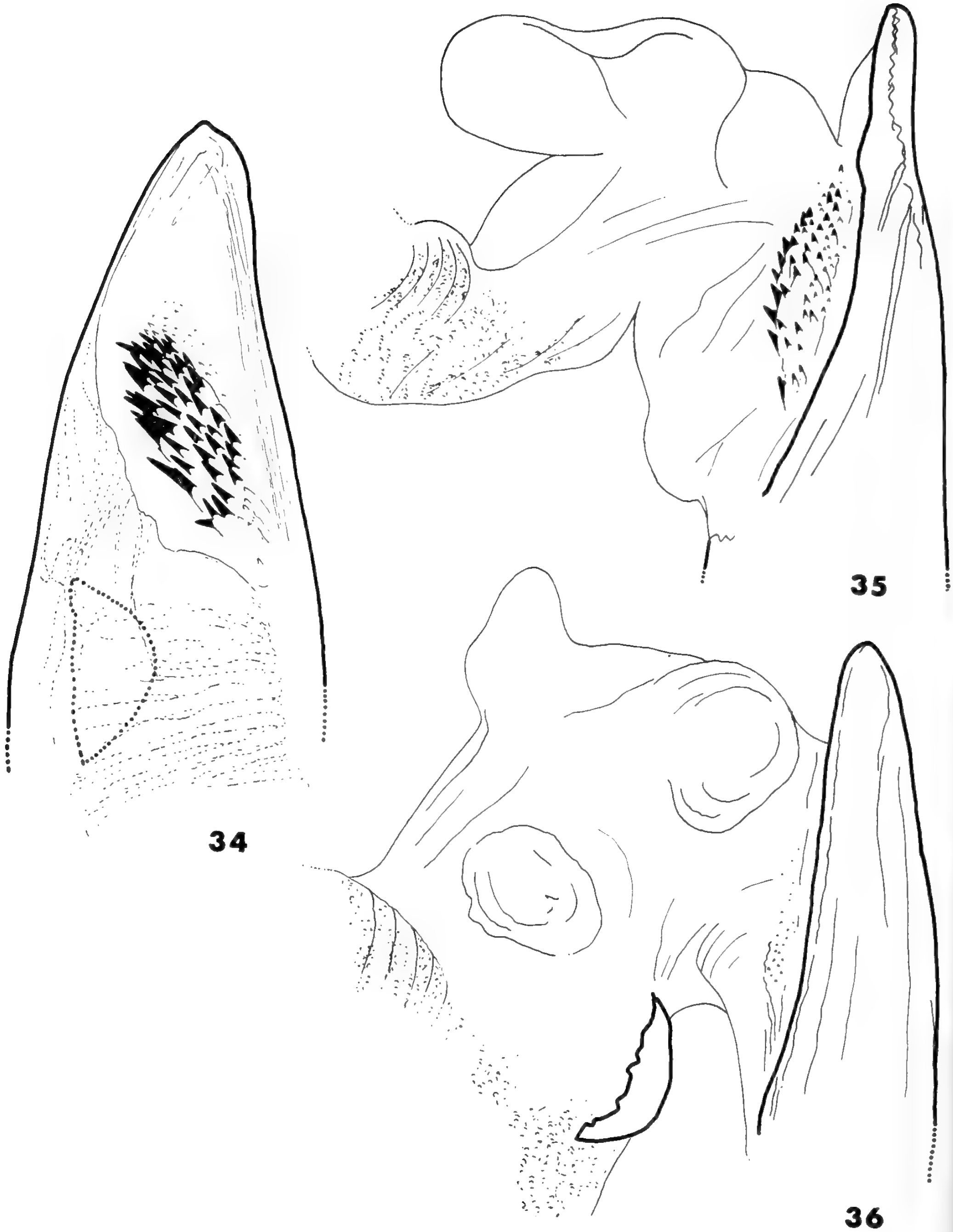
REMARKS. The absence of a cornutus in the male of *M. d. albiseriata* readily separates it from *M. d. metarhoda* and *M. d. decorata*; in each of the latter two a cornutus is present and well developed. *M. d. albiseriata* can also be distinguished from *M. d. metarhoda* on difference in fore wing pattern and hind wing colour, the postmedial white dots of the fore wing in *M. d. albiseriata* lie along the proximal margin of the postmedial band, in *M. d. metarhoda* they lie more-or-less centrally within it. The hind wing colour of *M. d. albiseriata* is white to light yellow, that of *M. d. metarhoda* greyish red, or greyish to brownish orange.

Masalia decorata metarhoda (Druce) **comb. et stat. n.**

(Text-figs 32, 36; Pl. 1, figs 124, 125; Map 2)

Timora metarhoda Druce, 1903 : 201. Lectotype ♀, GAMBIA (BMNH) [examined].
Timora metarhoda Druce; Hampson, 1903 : 106. [Lectotype designated.]

Fore wing with areole; length ♂ (20), 9·2–11·2, ♀ (27), 9·8–12·2 (lectotype). Wing pattern as in Pl. 1, figs 124, 125. Fore wing with upper surface ground colour light to greyish yellow; transverse and longitudinal markings pastel-red to pink; antemedial dots, when present, and postmedial dots, white. Hind wing with upper surface greyish red or greyish to brownish orange.



FIGS 34–36. *M. decorata* subspecies, ♂, scobinate bar and cornutus. 34, *M. d. decorata*. 35, *M. d. albiseriata*. 36, *M. d. metarhoda*.

Genitalia. ♂ with scobinate bar absent or poorly differentiated. Distal end of aedeagus and proximal part of vesica as in Text-fig. 36. ♀ with papilla analis simple, as in *M. d. decorata*.

MATERIAL EXAMINED

Lectotype, designated by Hampson, GAMBIA, ♀ (*A. Moloney*).

SENEGAL: Dakar, 3 ♂, 1 ♀, 12.ix.1956 (*C. Rungs*), in MNHN, Paris; Kaolack, 1 ♂ (*LeMoult*); 3 ♀ (*G. Melou*); N'dande, 1 ♂, 26.viii.1951 (*B. Boniface*), in MNHN, Paris. GHANA: Northern Territories, Navaro, 1 ♀; 1 ♂, x.1923 (both *A. W. Cardinall*). ? NIGER: Baban Tubki, south of Zinder, 1 ♀, 13.ix.1920 (*A. Buchanan*). NIGER: Damergou, Bande, 4 ♂, 7 ♀, 16.ix.1920; Kaleloua, 2 ♂, 3 ♀, 8.ix.1920; Makochia, 6 ♂, 8 ♀, 15.ix.1920; Tanout, 1 ♂, 6.ix.1920; Zinder, 1 ♀, 11.ix.1920 (all *A. Buchanan*). SUDAN: Khartoum, 1 ♂, 5.ix.1928 (*H. W. Bedford*); White Nile, 12–15 N., 1 ♀ (*Yardley*).

DISTRIBUTION (Map 2). Senegal, Gambia, Ghana, Niger and Sudan.

REMARKS. The absence of, or a poorly differentiated, scobinate bar in the male of *M. d. metarhoda* distinguishes it from both *M. d. albiseriata* and the nominate subspecies. In these latter two the scobinate bar is well developed. *M. d. metarhoda* can also be distinguished from *M. d. albiseriata* on difference in fore wing pattern and hind wing colour; the postmedial white dots of the fore wing in *M. d. metarhoda* lie more-or-less centrally within the postmedial band (Text-fig. 32), in *M. d. albiseriata* they lie along the bands proximal margin (Text-fig. 33). Hind wing colour of *M. d. metarhoda* is greyish red, or greyish to brownish orange, that of *M. d. albiseriata*, white to light yellow.

Masalia leucosticta (Hampson) **comb. n.**

(Text-figs 37, 38; Pl. 2, figs 126–130; Map 3)

Timora leucosticta Hampson, 1902 : 256.

M. leucosticta can be distinguished from the closely allied *M. decorata* by the difference in colour of the proximal area of the costal region, pink in *M. leucosticta*, pale to olive yellow in *M. decorata*; and from *M. funebris*, to which *M. leucosticta joiceyi* shows particularly close affinities, on difference in hind wing colour.

Three subspecies are recognized: *leucosticta, vinula* and *joiceyi*. The three are separable on fore wing differences and distribution. *M. l. vinula* and *M. l. joiceyi* have contiguous ante- and postmedial markings distinguishing them from *M. l. leucosticta* in which the markings are not contiguous. The distribution of *M. l. vinula* is northern Tanzania and northward to Ethiopia; that of *M. l. joiceyi*, southern Tanzania and westward to the southern Congo (Kinshasa). The areole, usually present in *M. l. vinula*, is rarely present in *M. l. joiceyi*.

Masalia leucosticta leucosticta (Hampson)

(Text-fig. 38; Pl. 2, figs 126–128; Map 3)

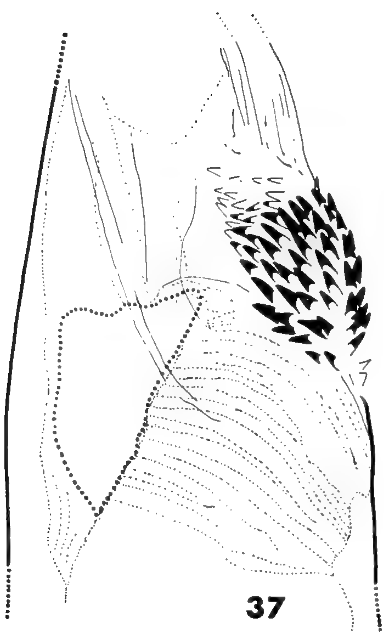
Timora leucosticta Hampson, 1902 : 256. Lectotype ♂, Botswana (BMNH) [examined].
Timora leucosticta Hampson; Hampson, 1903 : 107. [Lectotype designated].
Timora continuata Grunberg, 1910 : 126. LECTOTYPE ♂, South West Africa (MNHU, Berlin), here designated [examined]. **Syn. n.** [Gaede 1935 : 105 refers to *continuata* as a form, both of *metarhoda* and *leucosticta*].

Fore wing with areole usually present; length ♂ (66), 10·9–13·4 (lectotype 12·5), ♀ (51), 11·9–14·0. Wing pattern as in Pl. 2, figs 126–128. Fore wing upper surface with ground colour light yellow, transverse and longitudinal markings pink to greyish pink, postmedial dots and when present, antemedial dots white. Hind wing with upper surface white to pale yellow, immaculate or with subterminal or whole area behind subterminal region irrorate with greyish brown.

Genitalia. ♂ scobinate bar and cornutus (Text-fig. 38). ♀ with papilla analis simple.

Material examined.

Timora leucosticta, lectotype, designated by Hampson, [Botswana] N'Gami Country, ♂ (*F. D. Lugard*). *Timora continuata*, LECTOTYPE, here designated,



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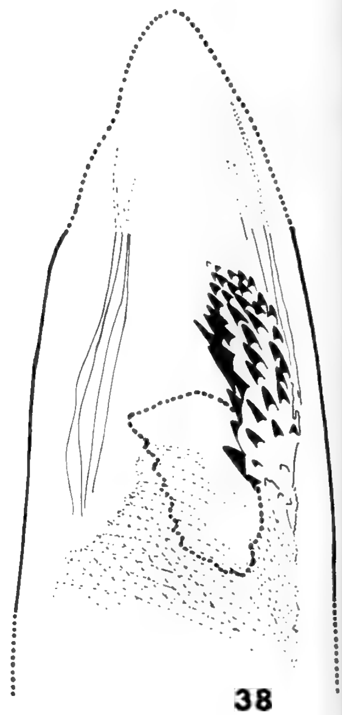

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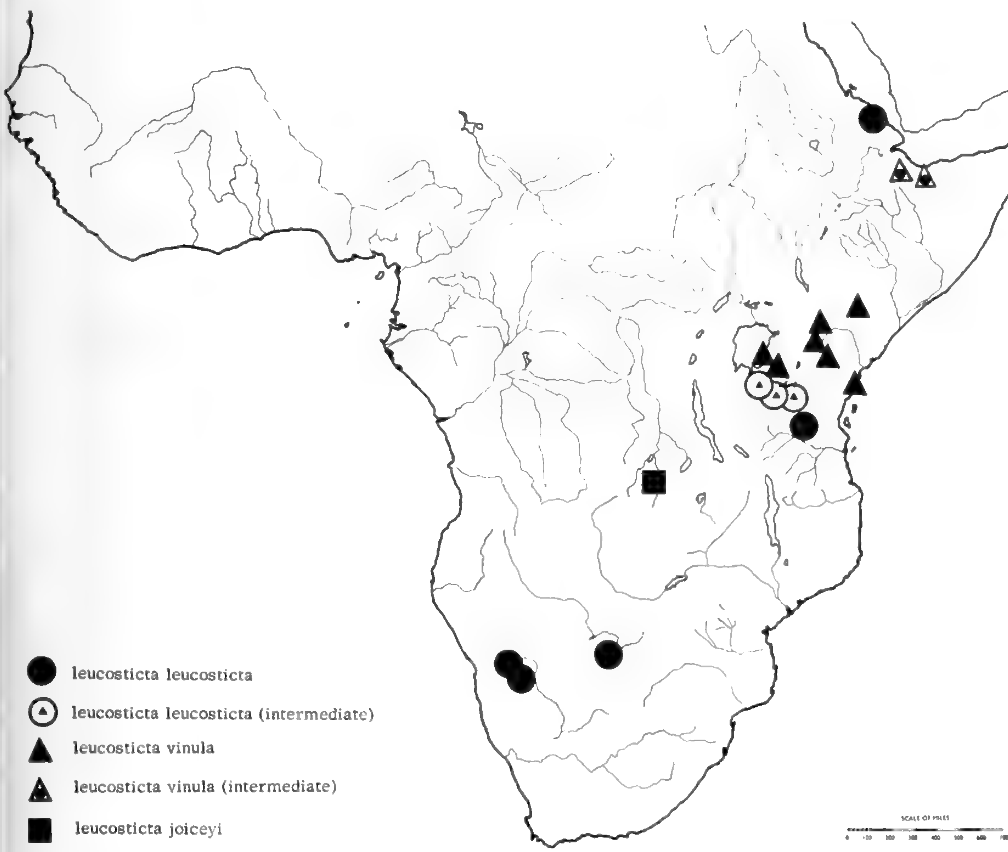
Figs 37–38. *M. leucosticta* subspecies, ♂, scobinate bar and cornutus. 37, *M. l. joiceyi*. 38, *M. l. leucosticta*.

South West Africa: Okahandja, [Windhoek] 'Windhuk', ♂, 24.ii.1909 (*S. G. Seewald*), MNHU, Berlin. South West Africa: Hoffnung (east of Windhoek), 1850 m, 5 ♂, 9.i.1934; 40 ♂, 38 ♀, 10.i.1934; 1 ♂, 30.i.1934 (all *K. Jordan*); Okahandja, 2 ♂, 20–26.i.1928; 1 ♂, 27.i.–2.ii.1928; 1 ♂, 1 ♀, 3–16.ii.1928; 2 ♂, 2–18.iii.1928; 2 ♂, 1 ♀, 19–29.iii.1928 (all *R. E. Turner*); 1 ♂, ii.1935 (*F. Gaerdes*); 1 ♂, 27.ii.1945; 1 ♂, 24.iii.1947; 1 ♂, 24.v.1947; 2 ♀, 25.iii.1954; 1 ♀, 5.iv.1953 (all *F. Gaerdes*), in ZSBS, Munich; Windhoek, 1 ♀ (*Knier*), in ZSBS, Munich; 1650 m, 1 ♂, 2 ♀, 16.i.1934; 2 ♀, 19.i.1934 (all *K. Jordan*); Tanzania: Kongwa, 2 ♂, 23.iv.1917 (*A. Loveridge*); District of Great Craters, 1 ♂, ii–iii.1921 (*T. A. Barns*); Mamboia, 1 ♂ (*Baxter*). The following specimens are intermediate between *M. l. leucosticta* and *M. l. vinula*, but placed with *M. l. leucosticta*: Kondoa Irangi (dry sandy country), 1 ♀, iii.1921 (*T. A. Barns*); Shinyanga, 1 ♀, i.1957 (*Croft*); Mwanza, 1 ♀, xii.1925–i.1926; Arusha District, Odeani Crater (dry thorn bush country), 1 ♀ (*T. A. Barns*).

Distribution (Map 3). South West Africa, Botswana and Tanzania.



Map 3. Distribution of subspecies of *M. leucosticta*.

REMARKS. The non-contiguous ante- and postmedial pink markings on the fore wing of *M. l. leucosticta* separate it from *M. l. vinula* and *M. l. joiceyi*; in these latter two subspecies the markings are contiguous.

Masalia leucosticta vinula (Berio) comb. et stat. n.

(Pl. 2, fig. 129; Map 3)

Timora vinula Berio, 1943 : 182. Holotype ♂, ETHIOPIA: Elaberet, 17.ix.1938 (*G. Vaccaro*) (Berio Coll., MCSN, Genoa).

Fore wing with areole usually present; length ♂ (42), 10·4–13·8, ♀ (13), 10·5–14·2. Wing pattern as in Pl. 2, fig. 129. Fore wing upper surface with ground colour light yellow; postmedial dots, and when present antemedial dots, white; other markings pink to greyish pink. Hind wing with upper surface pale yellow, immaculate, or pale yellow with subterminal or whole area behind subterminal region irrorate with greyish brown.

Genitalia. ♂ with scobinate bar and cornutus as in *M. l. leucosticta* (Text-fig. 38); ♀ papilla analis simple, as in *M. l. leucosticta*.

MATERIAL EXAMINED.

[TANZANIA:] Miriu River, 1 ♂, iii.1925 (*D. Hopkins*); Musoma, Banagi Hill, 2 ♂, 1 ♀, iii.1957. KENYA: Isiolo, 1 ♂, iv.–v.1951; 2 ♂, iv.1954 (*J. Adamson*); Makindu (south of Nairobi), 1 ♀, iii.1927 (*W. Feather*); Masongoleni, 1 ♀, 25.iii.1911; 1 ♂, 30.iv.1911; 1 ♀, 25.ix.1911; 1 ♂, 30.iv.1911 (all *W. Feather*); Mombasa, 2 ♂, vi.1916 (*van Someren*); Kibwezi, 2 ♀, 9.xii.1916; 8 ♂, 12.xii.1916; 1 ♂, 21.xii.1916; 1 ♀, 23.iv.1917; 1 ♂, 11.xii.1918; 6 ♂, 1 ♀, 19.xii.1918; 5 ♂, 22.xii.1918; 2 ♂, 1 ♀, 23.xii. 1918; 2 ♀, 13.iv.1919; 1 ♂, 2.v.1919; 1 ♂, 2.v.1919; 1 ♂, 2.v.1919; 1 ♂, 4.v.1919; 1 ♀, xii.1920; 1 ♂, 3 ♀, iv.1922 (all *W. Feather*). The following specimens show variation in pattern between *M. l. leucosticta* and *M. l. vinula* but are placed with *M. l. vinula*. ETHIOPIA: Harar, 1 ♂, 24.iv.1939 (*R. E. Ellison*); SOMALI REPUBLIC: Hargeisa, 4300 ft, 1 ♂, 1 ♀, v.1929 (*M. Portal-Hyatt*).

DISTRIBUTION (Map 3). Tanzania, Kenya, Ethiopia and Somali Republic.

REMARKS. The contiguous ante- and postmedial pink markings on the fore wing of *M. l. vinula* distinguish it from *M. l. leucosticta*. Differences between *M. l. vinula* and *M. l. joiceyi* are less marked; *joiceyi* tends to be of larger size and more robust in appearance and the areole, in contrast with *vinula*, is rarely present. *M. l. vinula* and *M. l. joiceyi* are separable on distribution, *vinula* occurring in northern Tanzania and northward to Ethiopia, *joiceyi* occurring in southern Tanzania and westward to the southern Congo (Kinshasa).

Type-specimens have not been examined; determination is based on a paratype photograph (Eritrea: Elaberet, ♂, 1.ix.1938) presented by Dr E. Berio and a specimen from the BMNH Collection identified by him.

Masalia leucosticta joiceyi (Prout) **comb. et stat. n.**

(Text-fig. 37; Pl. 2, fig. 130; Map 3)

Timora joiceyi Prout, 1921 : 119. Holotype ♂, CONGO (KINSHASA) (BMNH) [examined].

The subspecies is known only from male specimens.

Fore wing without areole; length ♂ (4), 13·6 (holotype)–16·5. Wing pattern as in Pl. 2, fig. 130. Fore wing upper surface with ground colour yellowish white to pale yellow, markings pink to greyish pink; postmedial and antemedial dots white. Hind wing upper surface white, with either subterminal or whole area finely to moderately irrorate with greyish brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 37.

MATERIAL EXAMINED.

Holotype, CONGO (KINSHASA): Lufira River near Likasi Copper Mine, 4000 ft, ♂, 6.xii.1918 (*T. A. Barns*).

CONGO (KINSHASA): Elisabethville, 1 ♂, 16.xii.1954 (*C. Seydel*). TANZANIA: Songea, 1 ♂, 19.i.1933 (*R. F. Johnstone*); ?; Ningpo, 1 ♂, in ZSBS, Munich.

DISTRIBUTION (Map 3). Congo (Kinshasa) and Tanzania.

REMARKS. *M. l. joiceyi* and *M. funebris* are closely allied; *M. funebris* is much darker in colour with extensive red areas in the fore wing and with its brown hind wings readily distinguished from *M. l. joiceyi*. The contiguous ante- and post-medial pink markings on the fore wing of *M. l. joiceyi* distinguish it from *M. l. leucosticta*. *M. l. joiceyi* and *M. l. vinula* are separable on distribution, *joiceyi* occurring in southern Congo (Kinshasa) and southern Tanzania, *vinula* occurring in northern Tanzania and northward to Ethiopia.

Masalia funebris (Berio) **comb. n.**

(Text-fig. 39; Pl. 2, fig. 131)

Timora funebris Berio, 1962 : 125. Holotype ♂, CONGO (KINSHASA) (MRAC, Tervuren) [examined].

The species is known only from male specimens.

Fore wing without areole; length ♂ (1), 14·7 (holotype). Wing pattern as in Pl. 2, fig. 131. Fore wing upper surface with costal and central regions bluish red, finely irrorate with brown; basal streak and outer marginal area pale to light orange; anal region brown, post- and ante-medial dashes white. Regions not clearly defined. Hind wing upper surface brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 39.

MATERIAL EXAMINED.

Holotype, [CONGO (KINSHASA):] [Elizabethville] Elisabethville, ♂, x.1933 (*C. Seydel*), in MRAC, Tervuren.

DISTRIBUTION. Southern Congo (Kinshasa).

REMARKS. *M. funebris* is most closely allied to *M. sublimis* and *M. leucosticta* particularly to *M. l. joiceyi*; the brown fore wing markings and brown hind wings of *funebris*, however, readily distinguish it from them.

Masalia prochaskai (Viette) comb. n.

(Text-fig. 40; Pl. 2, fig. 132)

Timora prochaskai Viette, 1957 : 271. Holotype ♂, MADAGASCAR: Betioky-Sud, i.1955 (*Prochaska*) (MNHN, Paris).

The species is known only from male specimens.

Fore wing with areole; length ♂ (1), 8·9. Wing pattern as in Pl. 2, fig. 132. Fore wing upper surface with ground colour light yellow; costal region, orbicular and discocellular spots, and post- and antemedial lines, greyish to dull red; post- and antemedial dots white, poorly differentiated. Hind wing upper surface pale yellow, suffused with dull red.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 40.

MATERIAL EXAMINED.

MADAGASCAR: Betioky-Sud, ♂, i.1955 (*Prochaska*), in MNHN, Paris.

DISTRIBUTION: Madagascar.

REMARKS. Allied to *M. decorata* and *M. leucosticta*. The absence of pink from the proximal area of the costal region in *M. decorata* distinguishes it from *M. prochaskai*. Differences between *leucosticta* and *prochaskai* are less marked; in *leucosticta* the pink longitudinal costal band is comparatively narrow, passing through only a part of the costal region, and often broken postmedially. In

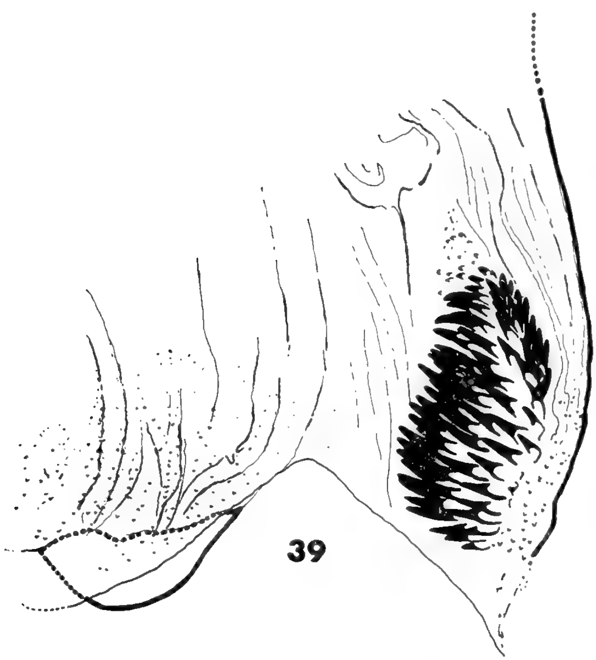


FIG. 39. *M. funebris*, ♂, scobinate bar and cornutus.

prochaskai the band is complete and much wider, occupying nearly the whole costal region.

The single specimen of *prochaskai* examined was determined by Dr P. Viette.

Masalia sublimis (Berio) **comb. n.**

(Text-fig. 41; Pl. 2, figs 133, 134)

Timora sublimis Berio, 1962 : 126. Holotype ♂, CONGO (KINSHASA) (MRAC, Tervuren) [examined].

Fore wing without areole; length, ♂ (8), 13·8–16·2 (holotype 14·6), ♀ (1), 15·3. Wing pattern as in Pl. 2, figs 133, 134. Fore wing upper surface with ground colour pastel-yellow; markings dull red to greyish pink. Hind wing upper surface white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 41. ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, CONGO (KINSHASA): Kalule Nord, ♂, i.1934 (*Seydel*), in MRAC, Tervuren.

?ANGOLA: 1 ♂, 31.xii.1912 (*Rohan-Chabot*), in MNHN, Paris; ANGOLA: 1 ♂, i.1913 (*Rohan-Chabot*); CONGO (KINSHASA); Elizabethville, 1 ♂, 31.xii.1932 (*C. Seydel*); Sandoa, Luiva, 1 ♂, 10.iv.1932 (*F. G. Overlaet*), both from Mus. Tervuren; Sandoa, 1 ♀, ii.1924, Zool. Staatssamml., München; ZAMBIA: Mumbwe, 1 ♂, 6.i.1957 (*R. C. Dening*); Mwengwa, 1 ♂, 18.i.1914 (*Dollman*); RHODESIA: Gwaai River, 1 ♂, 17.ii.1921 (*C. E. Godman*).

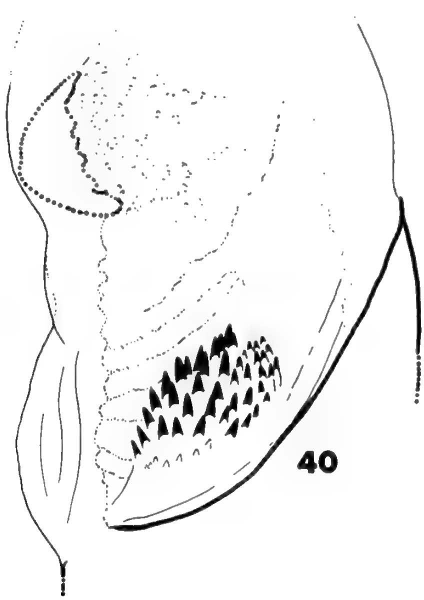


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FIG. 40. *M. prochaskai*, ♂, scobinate bar and cornutus.

DISTRIBUTION. Angola, Congo (Kinshasa), Zambia and Rhodesia.

REMARKS. *M. sublimis* is closely allied to *M. leucosticta*, *M. decorata* and *M. funebris*; the incomplete postmedial band and absence of postmedial white dots from the fore wing distinguish it from them. *M. sublimis* is not likely to be confused with any other species.

Masalia disticta (Hampson) **comb. n.**

(Text-figs 25, 42; Pl. 2, figs 135–137; Map 4)

Timora disticta Hampson, 1902 : 441.

M. disticta is separable from other species within the group and genus in possessing a white orbicular and white discocellular dot (Text-fig. 25).

Three subspecies are recognized; the nominate subspecies from South Africa, *flavirosea* from Central Africa and *albirosea* from East Africa (Map 4). The subspecies differ from one another in extent of fore wing pink and yellow colouring. In *albirosea*, known only from the worn type, the costal region is pink, the central and anal regions yellowish white. In subspecies *disticta*, the costal and anal regions are pink, the central region pale yellow. In *flavirosea* all three regions are pink, a pale yellow basal dash extending basi-posteriorly to the anal region.

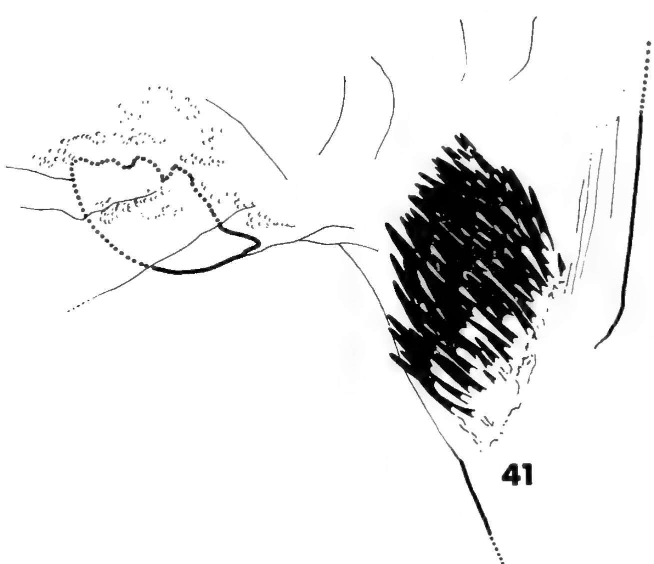

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FIG. 41. *M. sublimis*, ♂, scobinate bar and cornutus.

Masalia disticta disticta (Hampson)

(Text-fig. 42; Pl. 2, fig. 136; Map 4)

Timora disticta Hampson, 1902 : 441. Holotype ♂, LESOTHO (BMNH) [examined].

Fore wing with areole present, well developed; length ♂ (2), 15·3–16·2 (holotype), ♀ (2), 16·5. Wing pattern as in Pl. 2, fig. 136. Fore wing upper surface with costal and anal regions pink, central region pale yellow, orbicular and discocellular dots white. Hind wing upper surface white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 42. ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, [LESOTHO] Basutoland: Masite, ♂, 31.i.1902 (*S. Weigall*).

SOUTH WEST AFRICA: Okahandja, 1 ♀, 17.i.1958, in ZSBS, Munich; Windhoek, 1650 m, 1 ♀, 20.i.1934; SOUTH AFRICA: Pretoria, 1 ♂, 19.i.1906.

DISTRIBUTION (Map 4). South Africa.

REMARKS. The pale yellow central and pink anal region in the fore wing of *M. d. disticta* distinguishes it from *M. d. flavirosea* (central region pink) and *M. d. albirosea* (anal region white).

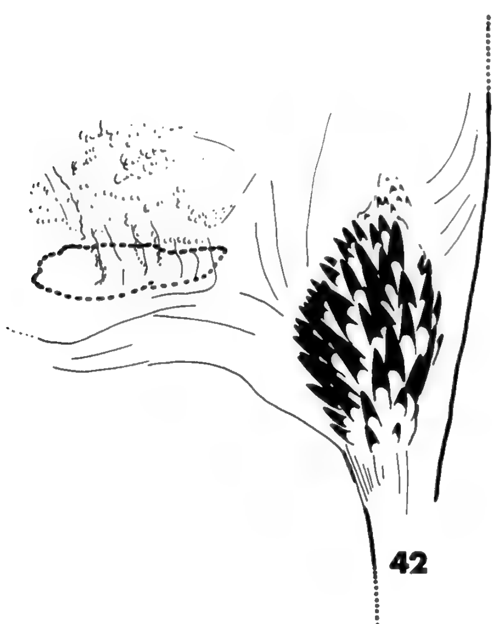

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FIG. 42. *M. disticta disticta*, ♂, scobinate bar and cornutus.

Masalia disticta albirosea (de Joannis) **comb. et stat. n.**

(Pl. 2, fig. 135; Map 4)

Timora albirosea de Joannis, 1913 : 124. LECTOTYPE ♂, Ethiopia (MNHN, Paris), here designated [examined].

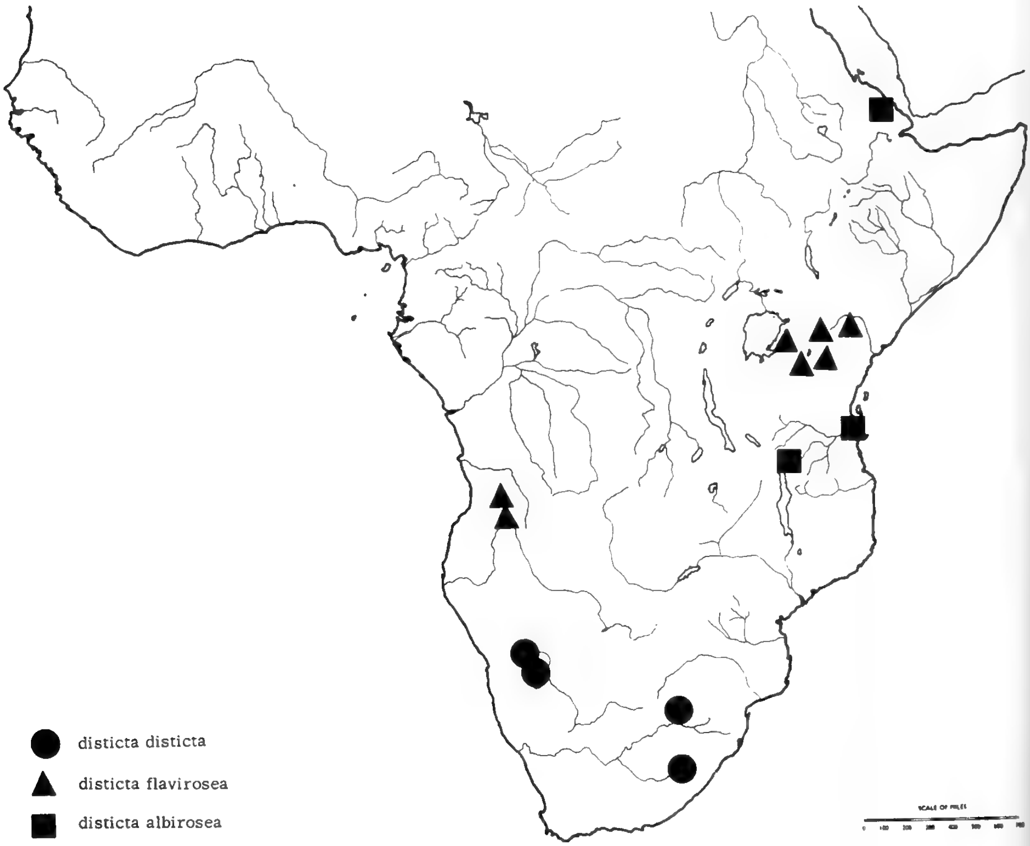
Fore wing with areole; length ♂ (1), 14·7 (lectotype). Wing pattern as in Pl. 2, fig. 135. Fore wing upper surface with costal region pink, central and anal regions yellowish white, orbicular and discocellular dots white. Hind wing upper surface white.

Genitalia. ♂ not examined but scobinate bar and cornutus almost certainly as in *M. d. disticta* (Text-fig. 42).

Material examined.

LECTOTYPE, here designated, [Ethiopia:] Eritrea, ♂, in MNHN, Paris.

Distribution (Map 4). East Africa.



Map 4. Distribution of subspecies of *M. disticta*.

REMARKS. The yellowish white central and anal regions in the fore wing of *M. d. albirosea* separate it from the nominate subspecies (anal region pink) and from *M. d. flavirosea* (central and anal regions pink).

As a species, *M. albirosea* was described from two specimens of which only one, labelled type, survives. Although in this specimen the pink fore wing markings are considerably rubbed, there is no trace of pink from the central or anal regions.

Masalia disticta flavirosea (Hampson) **comb. et stat. n.**

(Pl. 2, fig. 137; Map 4)

Timora flavirosea Hampson, 1903 : 111. Holotype ♂, KENYA (BMNH) [examined].

Fore wing with areole present, well developed; length ♂ (18), 13·6–18·5 (holotype 16·7), ♀ (3), 16·4–17·3. Wing pattern as in Pl. 2, fig. 137. Fore wing upper surface with ground colour pink, basal dash pale yellow, orbicular and discocellular dots white. Hind wing upper surface white.

Genitalia. ♂ scobinate bar and cornutus as in *M. d. disticta* (Text-fig. 42). ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, [KENYA:] Machakos, ♂, 9.xii.1898 (*R. Crawshay*).

ANGOLA: Cubal River, 1 ♂, iii.1899; Lepi, 3500 ft, 1 ♂ (*E. Robins*); Luimbale, 1800–1900 m, 7 ♂, 1 ♀, 15–20.iii.1934 (*K. Jordan*); TANZANIA: Arusha District, 1 ♀; Arusha District, Ngorongoro Crater, 5800–5900 ft, 3 ♂, 1 ♀, ii–iii.1921 (*M. S. Moore*); Musoma, 1 ♂; Njombe, 6000–6500 ft, 1 ♂, 25.ii.1952; KENYA: Athi River, 1 ♂, 13.v.1899 (*C. S. Betton*); Kikuyu District, 1 ♂; Kilindini, 1 ♂, 27.iv.1899.

DISTRIBUTION (Map 4). Central Africa.

REMARKS. *M. d. flavirosea* can be separated from *M. d. disticta* and *M. d. albirosea* on the colour difference of the central region of the fore wing: pink in *flavirosea*, yellowish white to pale yellow in *disticta* and *albirosea*.

THE *GALATHEAE-CRUENTATA* COMPLEX

This complex is made up of several variant lines tentatively arranged into two species, *M. galatheae* and *M. cruentata*.

Within the *galatheae*-group, *M. galatheae* and *M. cruentata* are closely allied to *M. disticta* and *M. flaviceps*. *M. galatheae* (excepting *M. g. bechuana*) and *M. cruentata* are separable from *M. disticta* on differences in the female papilla analis, which is modified in *M. galatheae* and *M. cruentata*, simple in *M. disticta*. Separation of *M. g. bechuana* and *M. disticta* can be made on the absence and presence, respectively, of a white fore wing orbicular and discocellular dot. With its white fore wings *M. flaviceps* is readily distinguished from *M. galatheae* and *M. cruentata*.

Differences between *M. galatheae* and *M. cruentata* are slight. In the fore wing pattern of *M. cruentata* the pink-red costal longitudinal marking is usually narrow and the boundaries of this and the pink-red, anal longitudinal marking toward the central region, are diffuse. In *M. galatheae* the pink-red, costal longitudinal marking

is wide, occupying most or all of the costal region and the boundaries of this and the pink-red, anal longitudinal marking, toward the central region, are sharply defined. In the female genitalia the papilla analis of *M. cruentata* is more pointed and it lacks the terminal spines found in *M. g. galatheae* (Text-figs 46–49, 52); in the male the scobinate bar of *M. cruentata* has fewer spicules (*cruentata* 10–40, *galatheae* 40–150).

Masalia galatheae (Wallengren) **comb. n.**

(Text-figs 43–51; Pl. 3, figs 138–149; Map 5)

Leocyma galatheae Wallengren, 1856 : 58.

The species is distributed across Africa and central and southern India.

Two subspecies are recognized, *galatheae* and *bechuana*, the latter being restricted to a region of southern Africa and structurally separated from the nominate subspecies on the difference in the female papilla analis, simple in *bechuana*, modified in *galatheae*. In the nominate subspecies, variation occurs in size, fore wing shape, presence or absence of an areole and in fore wing colour and pattern. Variation with respect to these four variables shows a fairly high degree of linkage, though a small number of apparently random intermediates do occur. On the basis of linked variation a number of forms are recognized; four, each formerly described as species, are referred to by their originally proposed names: *galatheae, imitata, nigrolineata* and *splendens*.

Masalia galatheae galatheae (Wallengren)

(Text-figs 43–49; Pl. 3, figs 138–144; Map 5)

Leocyma galatheae Wallengren, 1856 : 58. Holotype ♂, South Africa (NR, Stockholm) [examined].

Alaria lanceolata Walker, 1865 : 767. Holotype ♂, India (BMNH) [examined]. [Synonymized by Aurivillius, 1925 : 12.]

Adisura splendens Druce, 1887 : 685. LECTOTYPE ♂, Gambia (BMNH), here designated [examined]. [Synonymized with *lanceolata* by Hampson, 1903 : 111.]

Adisura imitata Druce, 1889 : 301. LECTOTYPE ♂, 'Costa Rica' [see below] (BMNH), here designated [examined]. [Synonymized with *lanceolata* by Hampson, 1903 : 111.]

Curubasa depicta Swinhoe, 1891 : 146. Holotype ♀, India (BMNH) [examined]. [Synonymized with *lanceolata* by Hampson, 1903 : 111.]

Timora galatheae (Wallengren) Aurivillius, 1925 : 12.

Timora nigrolineata Aurivillius, 1925 : 12. Holotype ♀, Uganda (NR, Stockholm) [examined]. **Syn. n.**

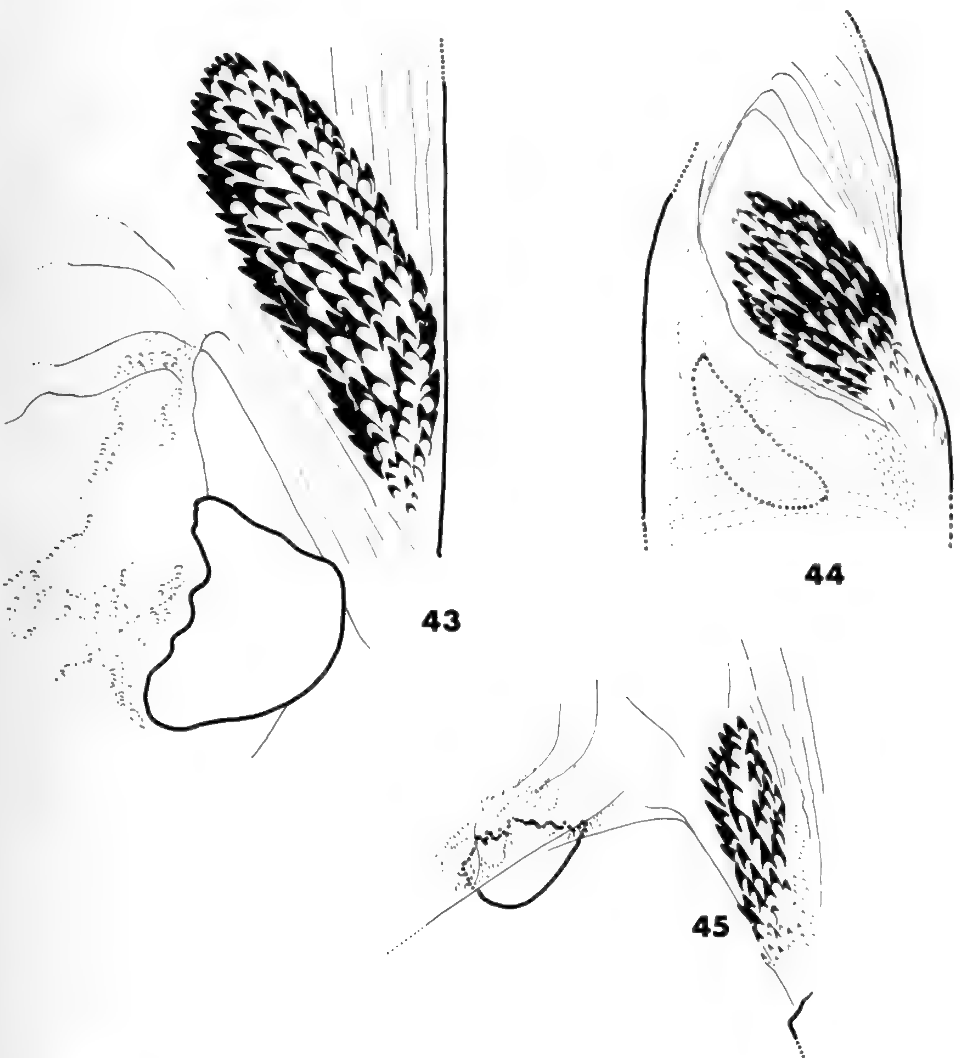
Timora vittulata Aurivillius, 1925 : 12. LECTOTYPE ♂, Sudan (NR, Stockholm), here designated [examined]. **Syn. n.**

Timora lancea Berio, 1953 : 2. Holotype ♀, Ethiopia: Neghelli, 1441 m, v-vii.1938 (*Nicotra*) (Berio Coll., MCSN, Genoa). **Syn. n.**

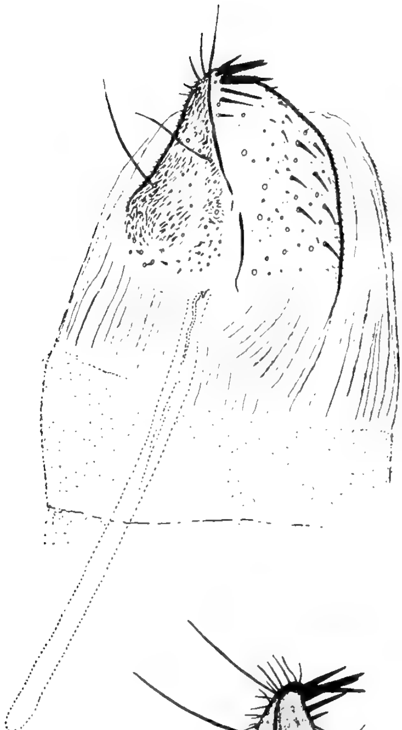
Fore wing with areole in all forms except *splendens*; length ♂ (421), 10·5–18·0 (holotype 13·8), ♀ (198), 11·7–20·0. Wing-pattern as in Pl. 3, figs 138–144. Fore wing upper surface with costal and anal regions pink, red or greyish red, central region white to light yellow; typical form and form *splendens* (Pl. 3, figs 138–141) with costal and anal regions pastel pink to greyish rose, central region white or yellowish white; form *nigrolineata* (Pl. 3, fig. 143) with costal and

anal regions greyish red to dull red, central region light yellow; form *imitata* (Pl. 3, fig. 142) with costal and anal regions red to brownish red, central region pale to light yellow. Hind wing upper surface white, immaculate or moderately irrorate with light brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 43–45. ♀ papilla analis modified; terminal spines present (Text-figs 46–49).



FIGS 43–45. *M. galatheae galatheae*, ♂, scobinate bar and cornutus. 43 and 45, extremes of range found in form *galatheae*. 44, form *imitata*.



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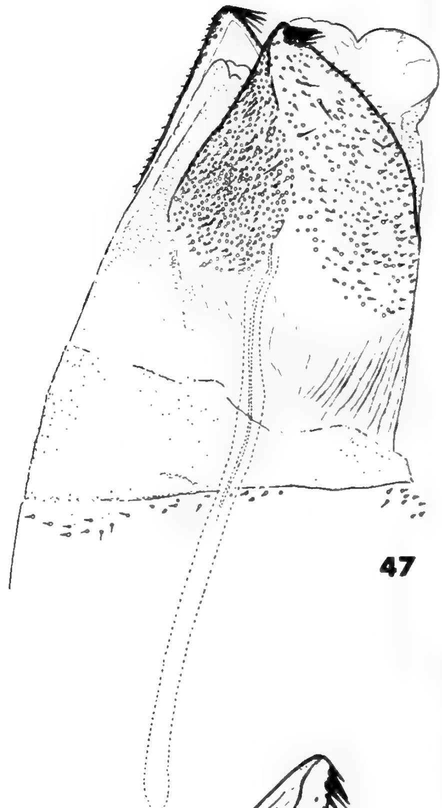

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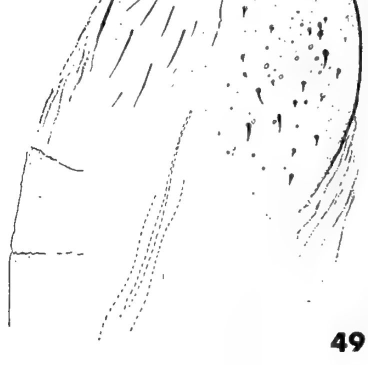

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FIGS 46–49. *M. galatheae galatheae*, ♀, papilla analis. 46 and 47, form *imitata*. 48, form *depicta*. 49, form *galatheae*.

MATERIAL EXAMINED.

Leocyma galatheae, holotype (labelled *Cucullia galathaea* Wallengren), [SOUTH AFRICA:] Caffraria, ♂ (*I. Vahlb*) ['Kaffern Wahlberg' in original description], in NR, Stockholm. *Alaria lanceolata*, holotype, [INDIA: Madras,] Coimbatoor, ♂ (*M. I. Walhouse*). *Adisura splendens*, LECTOTYPE, here designated, GAMBIA, ♀ (*A. Moloney*); paralectotype, [GAMBIA,] 1 ♂ (*Carter*). *Adisura imitata*, LECTOTYPE, here designated, 'COSTA RICA' [in fact almost certainly from West or Central Africa, the printed label 'Costa Rica Van Pattern' having been mistakenly added to the pin], ♂. *Curubasa depicta*, holotype, [INDIA: Maharashtra,] Khandala, ♀ (*C. Swinhoe*). *Timora nigrolineata*, holotype, [UGANDA]: Sembliki, Lake Edward, ♀ (*Swed. Exp. Centr. Africa*), in NR, Stockholm. *Timora vittulata*, LECTOTYPE, here designated, SUDAN: Renk, Nile, ♂, in NR, Stockholm; paralectotypes, SUDAN: ['Renk' according to original description] Nile, 2 ♂, 1 ♀ [type-series 3 ♂, 1 ♀, not 2 ♂, 1 ♀, as stated in original description], in NR, Stockholm.

SENEGAL: Gassane, 1 ♀, 27.viii.1907 (*W. Riggenbach*); Kaolack, 1 ♂, 4 ♀, 1909 (*G. Melou*); Sédhiou, 2 ♂, 2 ♀, 1917 (*H. Castell*); GHANA: Aburi, 1 ♂, 1 ♀, 14.x.1901 (*W. H. Johnstone*); Northern Territories, Kete-Krachi, 21 ♂, 29 ♀; Navaro, 1 ♂, viii.1923 (both *A. W. Cardinall*); TOGO: 3 ♀, 10–14.ix.1893; 1 ♀, 28.ix.1893 (both *L. Conradt*); NIGERIA: Ogruga [?Ogrugru], River Niger, 9 ♂, 2 ♀; Agbaja, 1 ♂, viii–ix.1913 (*D. Caton*); Assaba, R. Niger, 1 ♂ (*Crosse*); Ilesha, 5 ♂ (*Humfrey*); Minna, 4 ♂, 1–6.x.1910; 3 ♂, 1 ♀, 8–9.x.1910; 2 ♂, 18–19.ix.1899 (*G. Migeod*); CAMEROUN: Batouri District, Gadji, 4°30'N, 4°15'E, 750 m, 5 ♂, 1 ♀, 1935 (*F. G. Merfield*); GABON: Tchibanga, 1 ♀, iv.1952 (*P. Rougeot*); CENTRAL AFRICAN REPUBLIC: Fort Crampel, 1 ♂, 1 ♀; ANGOLA: Ambace, 6 ♂ (*Ansorge*); Capelongo-Dongo, 1 ♂, i.1913; Ceramba, 3 ♂, 2 ♀, iii.1903 (*W. C. Bell*); Cubal River, 1 ♂, iii.1899 (*Penrice*); Fazenda Congula, Amboim District, 7–800 m, 7–22.iv.1934 (*K. Jordan*); near Lobita, 1 ♂ (*K. H. Cohlan*); Luimbale, Mt. Moco, 1800–1900 m, 4 ♂, 13.iii.1934, 61 ♂, 9 ♀, 15–20.iii.1934, 1 ♀, 24.iii.1934 (*K. Jordan*); Lunda, Xa Sengue, 1 ♂, 2 ♀, 4–9.iv.1937 (*A. Exell*); Malange, Cocolo, 1 ♂, 10.iv.1937 (*A. Exell*); Quiculungo, 120 km N. of Lucala, 800 m, 5 ♂, 1 ♀, iv.1936 (*R. Braun*); Quirimbo, 75 km E. of Amboim, 300 m, 2 ♂, 1 ♀, 1–6.v.1934; 15 ♂, 26 ♀, 7–12.v.1934; 3 ♂, 4 ♀, 13–20.v.1934 (all *K. Jordan*); SOUTH AFRICA: 2 ♂; Daimana, near Ladysmith, 1 ♂ (*G. A. K. Marshall*); Maritzbourg, 1 ♀ (*Mills*); Modderfontein, 5 ♂, 1 ♀, xi.1920 (*A. V. Langshaw*); 1 ♂, 2 ♀, i.1921 (*A. V. Langshaw*); Natal, 1 ♂ (*Spitter*); 1 ♂; Duff's Road, 1 ♂; Pretoria, 2 ♀; 1 ♂, ii.1895; 1 ♀, 28.x.1894; 1 ♀, xi.1894 (all *W. L. Distant*); Tsomo, 1 ♀, (*J. H. Bowker*); White River, 1 ♀, xii.1908 (*A. T. Cooke*); Weenen, 1 ♀, 1 ♂, i–ii.1928 (*H. P. Thomasset*); Zutrsenka, Waterberg District, 1 ♀, 1.iii.1899. LESOTHO: 1 ♂, 2 ♀; RHODESIA: Mashonaland, 2 ♀ (*H. B. Dobbie*); 1 ♂, 16.xii.1897; 1 ♀, xii.1900; 4 ♂, xii.1904 (all *G. A. K. Marshall*); ZAMBIA: Chinundo Valley, near Lundazi, 1 ♀, 14.iii.1939 (*F. B. Macrae*); Fort Jameson, 3 ♂ (*J. M. Phipps*); Kaluluma Valley, near Lundazi, 1 ♀, 18.iii.1939 (*F. B. Macrae*); Nkala Valley, near Lundazi, 3400 ft, 2 ♂, 19.iii.1939 (*F. B. Macrae*); MALAWI: Kasangazi, near Bandawe, 3000 ft above L. Nyasa, 2 ♂ (*Prentice*); Magunda Estate, Luchenza, 1 ♀ (*F. Nisbet*); Mt. Mlanje, 1 ♂, 27.iii.1913; 2 ♂, 2.iv.1913 (*S. A. Neave*); Zomba Plateau, 1 ♂, iv.1920

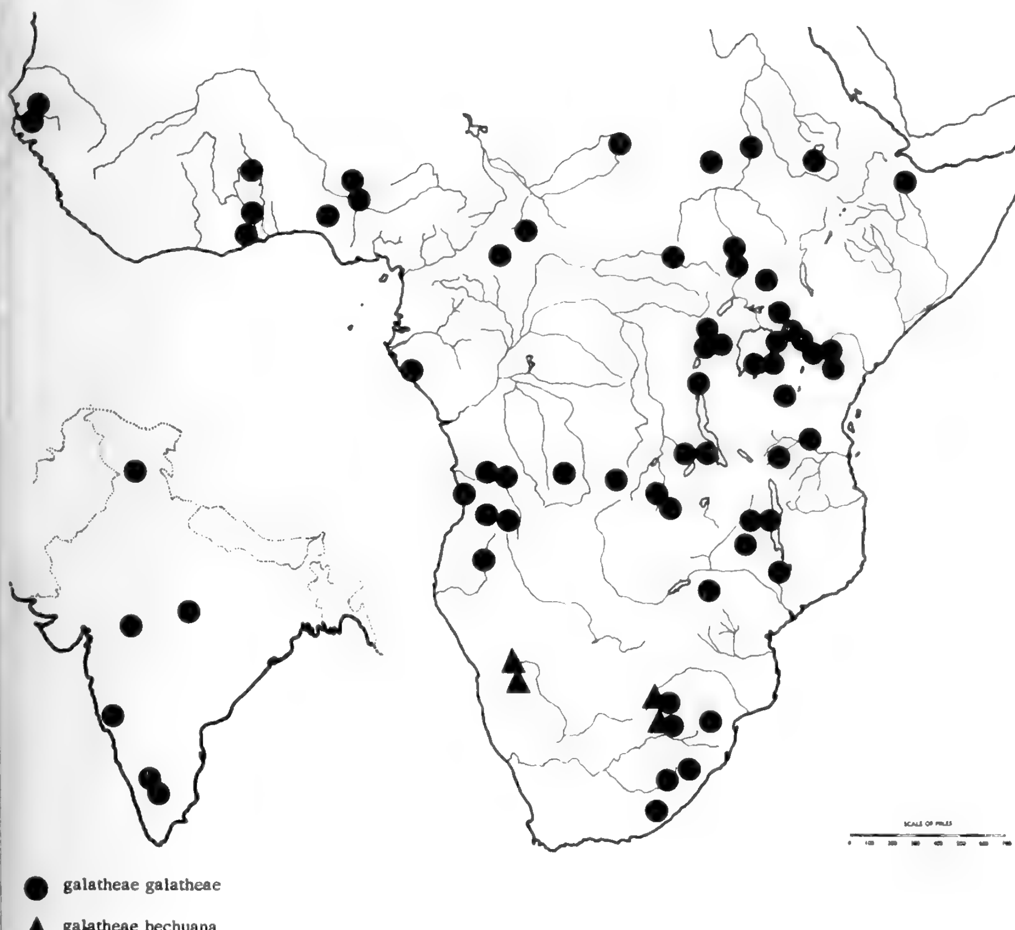
(*H. Barlow*); Zomba, 1 ♂, vi.1923 (*H. Barlow*); CONGO (KINSHASA): 1 ♂, Elisabethville, 1 ♀, iii.1925, 1 ♀, 27.iii.1934, 1 ♂ (*Bourguignon*), in MRAC, Tervuren; 2 ♂, 20.iii.1943 (*C. Seydel*), in ZSBS, Munich; 1 ♂, 20.iii.1950 (*C. Seydel*), in MRAC, Tervuren; 9–14.iv.1955 (*C. Seydel*), in ZSBS, Munich; Katanga, Kafakumba, 7 ♂, 1 ♀, iii.1927; Kambove, 4000–5000 ft, 1 ♂, 4.iv.1907; Kassonyi, 1 ♂, viii.1937 (*J. Breolo*), in MRAC, Tervuren; Likasi, 4000 ft, 1 ♂, 20.iii.1919 (*T. A. Barns*); East Luvua Valley, 5700 ft, 2 ♂, ii.1922 (*T. A. Barns*); 3000 ft, 1 ♂, iv.1922 (*T. A. Barns*); Omkoro, 1 ♂, 6.iii.1926; Usumbura, 1 ♂, 5.iv.1926 (*F. G. Jackson*); TANZANIA: Kigonsera, 1 ♂, in ZSBS, Munich; Kilosa, 1 ♂, 19.iv.1923 (*Loveridge*); Madibira, 1 ♂, in ZSBS, Munich; Marungu Plateau, 7000 ft, 2 ♂, 4 ♀, ii.1922 (*T. A. Barns*); Mbeya, 1 ♂, (*E. Ross*); 1 ♂, iii.1950 (*N. Mitton*); Musoma, Banagi Hill, 3 ♂, 2 ♀ (*M. S. Moore*); Shinyanga, Mwandui, 4 ♂, ii.1952 (*Croft*); Ukerewe Island, 1 ♂ (*Conrad*); RWANDA: Gabiru, 1 ♀, 18.x.1932 (*L. A. Burgeon*), in MRAC, Tervuren; UGANDA: 1 ♀ (*W. L. Doggett*); 1 ♂, 17.iii.1923 (*H. Hargreaves*); Ankole, 1 ♂, 5.vii.1928, 1 ♂, 14.x.1928 (both *J. Gastrell*); Motuba Unyoro, 3 ♂, 18.x.1901 (*C. S. Betton*); North Buddu, 3800 ft, 1 ♂, 18.ix.1911 (*S. A. Neave*); south of Lake George, 3200 ft, 1 ♂, 18.x.1911 (*S. A. Neave*); Kickwamba, 1 ♂ (*C. Christy*); Karamoja, Mt. Toror, 1 ♂, vi.1949 (*T. H. E. Jackson*); Mbarara, 1 ♂ (*R. E. McConnell*); Mulema, 1 ♀, v.1903 (*W. L. Doggett*); S. E. Ruwenzori, 3500 ft, 2 ♂, 16 & 20.iv.1906 (*G. Legge & A. F. R. Wollaston*); KENYA: Athi River, 1 ♂, 10.v.1899 (*C. S. Betton*); Eburra, 1 ♂, 21.iii.1900, 1 ♀, 25.iii.1900 (both *C. S. Betton*); Mt. Elgon, 1 ♀, iv.1925 (*G. W. Jeffery*); 1 ♂, v.1934 (*T. H. E. Jackson*); south-west slopes, 2 ♂, 1 ♀ (*H. B. Labbury*); South Kavirondo, Suna, 1 ♀, 20.iii.1930; 3 ♂, iv.1930; 1 ♀, ix.1930; 1 ♂, x.1930; 18 ♂, 1 ♀, iii.1931; 5 ♂, iv.1931; 1 ♂, x.1931; 7 ♂, 2 ♀, xi.1931; 11 ♂, 1 ♀, xii.1931; 3 ♂, i.1932; 1 ♂, 2 ♀, iii.1932; 14 ♂, 12 ♀, iv.1932; 1 ♂, 1 ♀, vi.1932 (all *W. Feather*); Kibauni, 2 ♂, 1 ♀, 4–5.xii.1898 (*R. Crawshay*); Kibwezi, 1 ♀, xii.1921 (*W. Feather*); Kikuyu, near Nairobi, 5400 ft, 1 ♂, 24.iii.1900 (*R. Crawshay*); Kitale, 1 ♂, 10.iv.1931 (*G. W. Jeffery*); 6 ♂, vi–vii.1934 (*G. W. Jeffery*); Lumbwa, 1 ♂, 8.iv.1923 (*G. W. Jeffery*); Machakos, 1 ♂, 13.v.1898; 1 ♂, 6.vi.1898; 1 ♀, 10.xii.1898 (all *R. C. Crawshay*); Mosangaleni, 1 ♂, 25.iv.1928 (*G. H. E. Hopkins*); Nairobi, 1 ♂; 1 ♂, 19.iii.1905 (*F. J. Jackson*); 11 ♂, 1 ♀, iv.1905 (*F. J. Jackson*); 5650 ft, 1 ♂, 11.v.1915 (*A. Loveridge*); 1 ♂, 25.iv.1916 (*W. A. Lamborn*); 1 ♀, 23.vi.1918; 1 ♂, x.1918; 1 ♂, xi.1918 (all *W. H. van Someren*); 2 ♂, iii. 1926 (*van Someren*); 1 ♂, iii.1927 (*D. M. Hopkins*); 2 ♂, 1 ♀, iv.1927 (*D. M. Hopkins*); 1 ♀, xi.1928; 2 ♂, iv.1937; 1 ♂, vii–viii.1936 (all *van Someren*); Nakuru, 2 ♂, 2 ♀, 1 ♂, 6.vi.1943; 1 ♂, 9.iv.1947; 1 ♂, 1.v.1949; 1 ♀, 18.v.1950; 1 ♂, 11.v.1952 (all *A. Townsend*); Nakutu, 1 ♂, 8.v.1921 (*H. A. Bodeker*); Nandi, Moboroni, 1 ♂, vii.1903 (*J. J. Jackson*); Ngong, 1 ♂, vi.1943 (*van Someren*); ETHIOPIA: Dangila, 2 ♂, 9–10.ix.1926; 1 ♂, 29.viii.1930; 3 ♂, 13.ix. 1930; 1 ♂, 1 ♀, 1 & 26.ix.1932; Dib Qan, 1 ♂, 22.ix.1932 (all *R. E. Cheesman*); Harar, 1 ♂, 27.viii.1937; 2 ♂, ix–x.1939 (all *R. E. Ellison*); SUDAN: Blue Nile Province, Toz, 1 ♂, 20.viii.1960 (*H. Schmutterer*), in ZSBS, Munich; Darfur Province, Kulme, 7 ♀, vi–x.1921 (*H. Lynes*); Gondokoro, White Nile, 3 ♂ (*W. E. Rymes-Cole*); 2 ♂ (*Dabbene*); Kordofan Province, Kadugli, 1 ♀, 29.viii.1962 (*H. Schmutterer*), in ZSBS, Munich; Mongalla, White Nile, 5 ♂, 20.x.1917 (*Yardley*); Tambura, 4 ♂, 2 ♀; White Nile, 10°12′N, 2 ♂, 5 ♀ (*Yardley*); INDIA: southern India, 6 ♂, 2 ♀; Madras, Nilgiris, 1 ♂,

1 ♀; Madhya Pradesh, Jubblepore, 1 ♀, 17.ix.1905 (*C. S. Betton*); M. P., Mhow, 1 ♂, 1 ♀, ix.1886 (*C. Swinhoe*); M. P., Wynaad, 2 ♂; Mysore, Belgaum, 1 ♂ (*T. R. Bell*); M., Belgaum, 1 ♀, 29.ii.1922 (*T. R. Bell*).

Distribution (Map 5). Africa south of the Sahara; central and southern India.

Remarks. This subspecies may be recognized by the modified form of the papilla analis, which is simple in *M. g. bechuana*.

The synonymy of *Timora lancea* is based on a photograph presented by Dr E. Berio of one of the paratypes, and on a specimen from the BMNH Collection identified by him.



Map 5. Distribution of subspecies of *M. galatheae*.

Masalia galatheae bechuana subsp. n.

(Text-figs 50, 51; Pl. 3, figs 145–149; Map 5)

Fore wing with areole; length ♂ (10), 12·6–15·0 (holotype 14·2), ♀ (18), 12·7–16·5. Wing pattern as in Pl. 3, figs 145–149. Fore wing upper surface with costal and anal regions either light yellow or dull red to greyish pink; central region pale yellow immaculate or irrorate between veins with dark brown. Hind wing upper surface white to pale yellow.

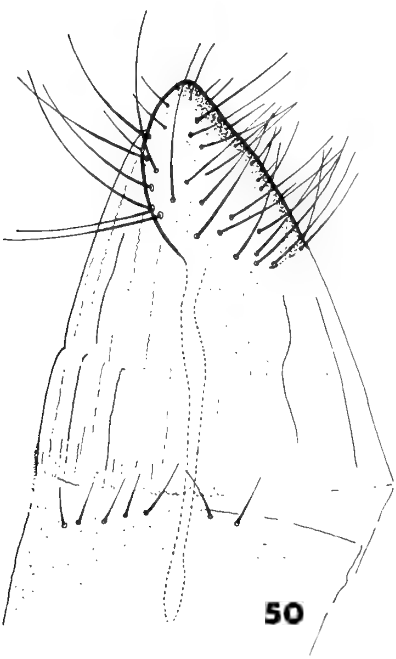
Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 51. ♀ papilla analis simple (Text-fig. 50).

MATERIAL EXAMINED.

Holotype, [BOTSWANA] British Bechuanaland: Upington, ♂, 13.iii.1950 (*H. B. Kettlewell*).

Paratypes. SOUTH WEST AFRICA: Hoffnung, 1850 m, 3 ♂, 10.i.1934; Okahandja, 1 ♂, 10–16.ii.1928; 1 ♀, 2–18.iii.1928 (both *R. E. Turner*); 1 ♀, 4.iii.1949; 1 ♀, 30.i.1953; 1 ♂, 1 ♀, 30 and 25.i.1954; 3 ♀, 24–25.iii.1954 (all *F. Gaerdes*), in ZSBS, Munich; Windhoek, 1650 m, 2 ♀, 16 and 23.i.1934 (*K. Jordan*); [BOTSWANA] British Bechuanaland: Okahandja, 1320 m, 1 ♂, 1–4.i.1934 (*K. Jordan*); Upington, 1 ♂, 10 ♀, 12–14.iii. 1950 (*H. B. Kettlewell*); [SOUTH AFRICA] Transvaal: Zutrsenka (Waterberg District), 1 ♂, i–iii.1899.

DISTRIBUTION. South West and South Africa.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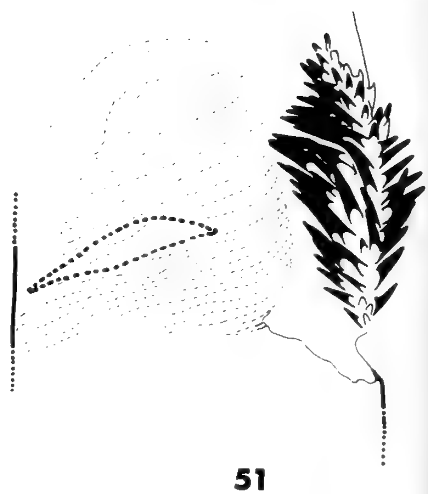
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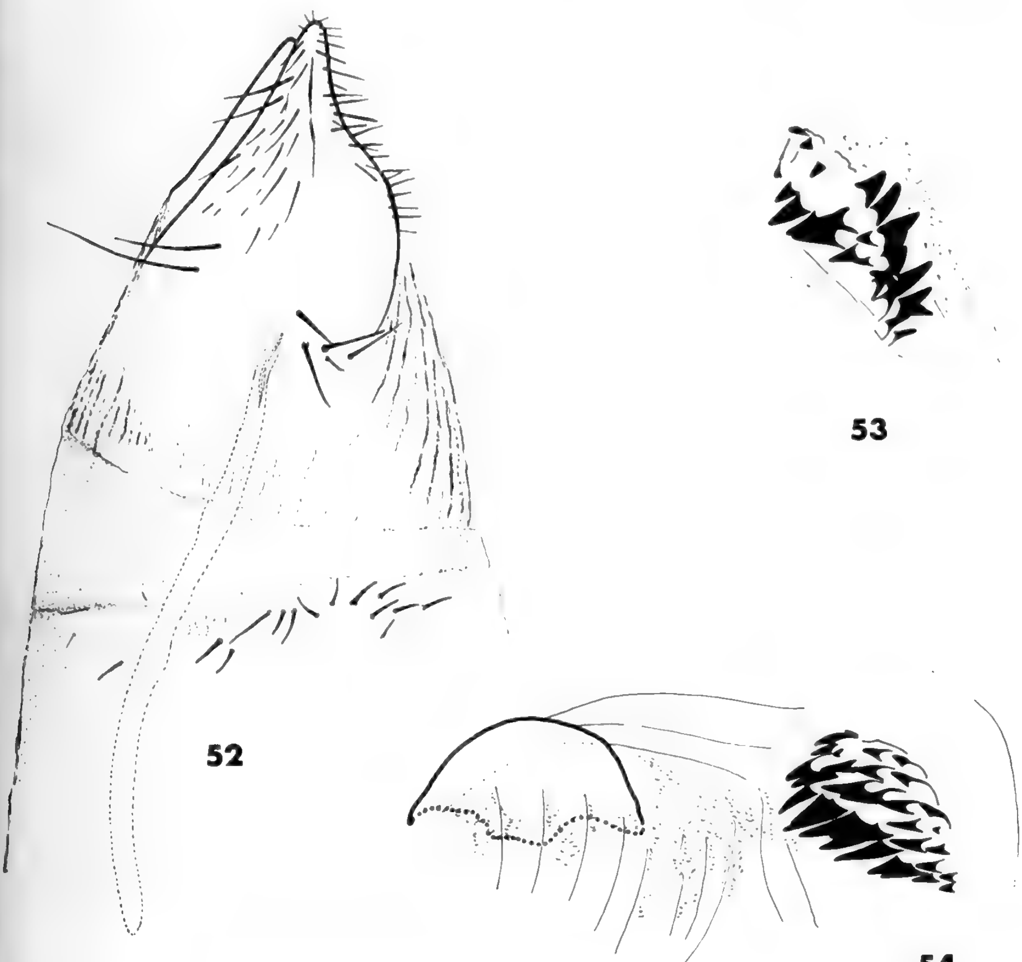
FIGS 50–51. *M. galatheae bechuana*, genitalia. 50, ♀, papilla analis. 51, ♂, scobinate bar and cornutus.

REMARKS. *M. g. bechuana* can be separated from the nominate subspecies on difference in the female papilla analis, simple in *M. g. bechuana*, of modified form in *M. g. galatheae*.

Masalia cruentata (Moore) **comb. n.**

(Text-figs 52–54; Pl. 4, figs 150–152; Map 6)

Curubasa cruentata Moore, 1881 : 367. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].
Curubasa marginata Moore, 1881 : 367. LECTOTYPE ♀, INDIA (BMNH), here designated [examined]. [Synonymized by Hampson, 1903 : 112.]
Timora cruentata (Moore) Hampson, 1903 : 112.



FIGS 52–54. *M. cruentata*, genitalia. 52, ♀, papilla analis. 53 and 54, ♂, scobinate bar and cornutus.

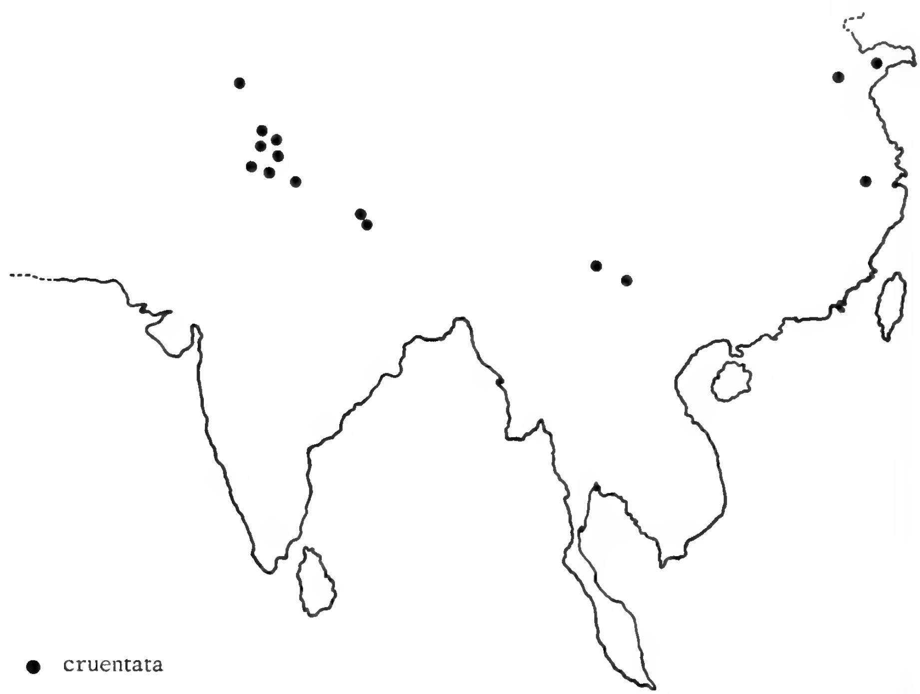
Fore wing with areole usually present; length ♂ (52), 11·2–18·5 (lectotype 14·1), ♀ (32), 12·7–18·2. Wing pattern as in Pl. 4, figs 150–152. Fore wing upper surface with costal region white to pale yellow, immaculate or costa tipped with pink or pale or greyish red; occasionally entire costal region pink, pale or greyish red. Central region white to pale yellow; anal region pink, pale or greyish red or light to reddish brown. Hind wing upper surface white to pale yellow, immaculate or lightly irrorate with greyish brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 53, 54. ♀ papilla analis modified, terminal spines absent (Text-fig. 52).

MATERIAL EXAMINED.

Curubasa cruentata, LECTOTYPE, here designated, [INDIA:] North West India (Cashmir, Noashera—from original description), (labelled ♀); paralectotype, [INDIA:] North West India, ♀. *Curubasa marginata*, LECTOTYPE, here designated, [INDIA]: North West Himalaya, ♂; paralectotype, [INDIA:] North West India, ♀.

INDIA: Himachal Pradesh, Dharmsala, 3 ♂; H.P., Kasauli, 1 ♂, 28.viii.1905; H.P., Kula District, 1 ♂, 5 ♀; H.P., Sabathu, 1 ♀, vii.1889; H.P., Solon, 3 ♂, viii.1896; 1 ♂, ix.; H.P., Sultanpur, 1 ♀; NEPAL: Pakhara, 28°14′N, 83°59′E, 1 ♂, 16.ix.1955; Tuckucha, 28°43′N, 83°39′E, 1 ♀, 12.ix.1955—both Zool. Staatssamml., München. TIBET: Batang, 2800 m, 1 ♀, 17.viii.1936; 1 ♂, 21.viii.1936—both Mus. Bonn; CHINA: Chekiang, West Tien-mu-shan, 1 ♂, 24.iv.1932; Shantung, Tai-shan, 1550 m, 1 ♀, vi.1934; 1 ♂, 3.viii.1934; 1 ♀, 5.viii.1934; 1 ♂, 4.viii.1934; 1 ♂, 1 ♀, 8.viii.1934;



MAP 6. Distribution of *M. cruentata*.

2 ♀, 9.viii.1934; 10 ♂, 3 ♀, 11.viii.1934; 5 ♂, 1 ♀, 12.viii.1934; 5 ♂, 4 ♀, 13.viii.1934; 1 ♂, 17.viii.1934; 1 ♂, 1 ♀, 28.viii.1934—all in MAK, Bonn; Tsekou, 3 ♂, 2 ♀; Yunnan, 1 ♂, 1 ♀, 1918; Yunnan, Li-Kiang, 2000 m, 1 ♀, 24.vii.1934; 1 ♂, 8.viii.1934; 1 ♀, 18.x.1934; 1 ♀, 25.vii.1935—Li-Kiang material from MAK, Bonn.

DISTRIBUTION (Map 6). North India, Nepal, Tibet and south-west and central east China.

REMARKS. Differences between *M. cruentata* and the closely related *M. galatheae* are given under the heading of *galatheae–cruentata* complex. The material from Tai-shan is atypical in that, with few exceptions, an areole is absent; a long series was collected from this locality. The similarity to one another in other respects of these specimens, and the short period over which they were caught, suggests that they formed part of a local inbred population.

Masalia flaviceps (Hampson) comb. n.

(Text-figs 55, 56; Pl. 4, fig. 159)

Timora flaviceps Hampson, 1903 : 116. Holotype ♂, NIGERIA (BMNH) [examined].

Fore wing without areole; length ♂ (34), 11·0–13·2 (holotype 12·0), ♀ (6), 12·4–14·0. Wing pattern as in Pl. 4, fig. 159. Fore wing upper surface white; in a few specimens the costal and anal regions are slightly tinged with yellow, with just sufficient contrast for divisions between the regions to be made. Hind wing upper surface white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 56. ♀ papilla analis modified; terminal spines present and dorso-lateral surface clothed in fine hair (Text-fig. 55).

MATERIAL EXAMINED.

Timora flaviceps, holotype, NIGERIA: Borgu, Yelwa Lake, ♂, 2.x.1899 (*G. Migeod*).

SENEGAL: Kaolack, 7 ♂, 1 ♀, 1909 (*G. Melou*); GHANA: Kete-Krachi, 16 ♂, 3 ♀ (*A. W. Cardinall*); Navaro, 2 ♂, 1 ♀, x.1923 (*A. W. Cardinall*); NIGERIA: Minna, 1 ♂, 1 ♀, 13.x.1910 (*Scott Macfie*); Zungeru, 2 ♂, 25.x.1910 (*Scott Macfie*); SUDAN: White Nile, 11°12′N, 2 ♂ (*Yardley*); 11°15′N, 2 ♂ (*Yardley*); ETHIOPIA: 1 ♂ (paralectotype of *Timora hololeuca* Hampson).

DISTRIBUTION. From West Africa to Ethiopia.

REMARKS. *M. flaviceps* is probably most closely allied to *M. galatheae*. Structurally there is no apparent difference, and differentiation of the wing regions traceable in a few specimens of *M. flaviceps* reveals the *M. galatheae* pattern. Never the less, on colour the two species are readily distinguished: in *M. flaviceps* the costal and anal regions are white or white tinged with yellow, whereas in *M. galatheae* the costal and anal regions are pink. *M. hololeuca*, the only other white species in *Masalia*, can be separated on difference in the form of the female papilla analis: modified in *M. flaviceps*, simple in *M. hololeuca*.

Masalia hololeuca (Hampson) **comb. n.**

(Text-fig. 57; Pl. 4, fig. 153)

Timora hololeuca Hampson, 1903 : 117. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].

Fore wing with areole; length ♂ (10), 11·1–13·5 (lectotype 11·9), ♀ (10), 12·6–15·0. Wing pattern as in Pl. 4, fig. 153. Fore wing upper surface white. Hind wing upper surface white. Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 57. ♀ papilla analis simple.

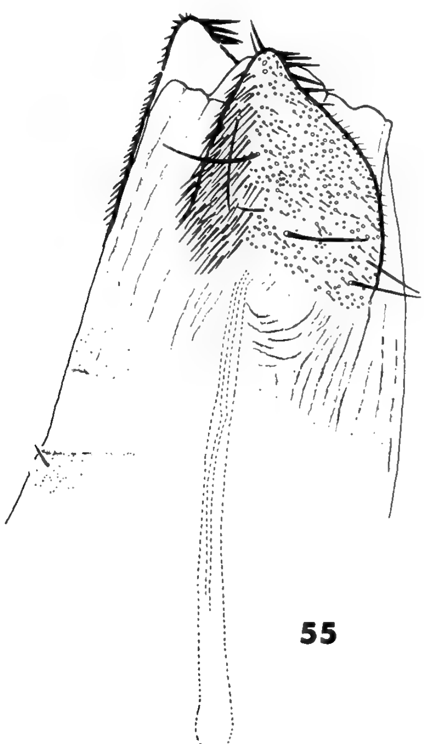
MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA: Mysore] Madras, Belgaum, ♂, x.1896 (*Watson*).

INDIA: Maharashtra, Nasik, 2 ♂, 1 ♀, ix.1892; southern India, 5 ♂, 5 ♀ (*T. R. Bell*); ?, C. Rock, 2 ♂, 5 ♀, x. 1892.

DISTRIBUTION. Central and southern India.

REMARKS. *M. hololeuca* can be distinguished from *M. flaviceps* (the only other white species in the genus) on the absence and presence, respectively, of an areole,



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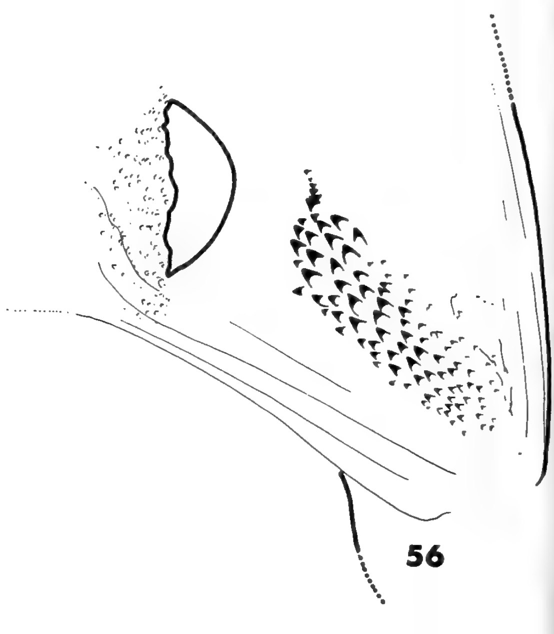


56

FIGS 55–56. *M. flaviceps*, genitalia. 55, ♀, papilla analis. 56, ♂, scobinate bar and cornutus.

and in the female, on the difference in form of the papilla analis, simple in *M. hololeuca* and modified in *M. flaviceps*.

The type-series of this species comprised three males, two from India and one from Ethiopia. The Ethiopian male is in fact a specimen of *M. flaviceps*, and the second Indian male is lost.

Masalia radiata Moore

(Text-figs 58–61; Pl. 4, figs 154–158)

Masalia radiata Moore, 1881 : 364.

M. radiata, though showing variability in colour, is marked similarly to other species within the group. Two subspecies are recognized, the nominate subspecies, a small brown moth from northern India and *M. r. terracotta*, larger, light to reddish brown, from central and southern India, west Bengal and Sikkim. Within the *radiata*-group, *radiata* can be separated from all but one species, *flavistrigata*, on differences in structure of the female genitalia. In *radiata* the papilla analis is modified; in *rubristria*, *beatrix* and *epimethea*, simple. In *roseivena* and *rosacea*, which have modified papilla anali, terminal spines are present, but these are lacking in *radiata*. Though the relationship between *radiata* and *flavistrigata* is probably no closer than between *radiata* and any other species in the group, no single character common to both subspecies has been found to separate *radiata* from *flavistrigata*.

FIG. 57. *M. hololeuca*, ♂, scobinate bar and cornutus.

Each subspecies however, can be separated using a different single character, the brown upper surface of the hind wing in *M. r. radiata* and the non-overlapping scobinate bar spicules in *M. r. terracotta*. In *flavistrigata* the upper surface hind wing colour is white and the scobinate bar spicules overlap.

Masalia radiata radiata Moore

(Text-fig. 59; Pl. 4, figs 154, 155)

Masalia radiata Moore, 1881 : 364. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].

The subspecies is known only from male specimens. The papilla analis is assumed to be as in *M. r. terracotta*.

Fore wing with areole; length, ♂ (2), 10·6 (lectotype). Wing pattern as in Pl. 4, figs 154, 155. Fore wing upper surface with ground colour brownish orange to light brown; upper central longitudinal streak white. Hind wing upper surface brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 59.

MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA: Uttar Pradesh,] N. W. Provinces, [Mainpuri] Manpuri, 1 ♂.

INDIA: Rajasthan, Ajmer, 1 ♂, 14.viii.1892.

DISTRIBUTION. North India.

REMARKS. Externally *M. r. radiata* can be distinguished from *M. r. terracotta* on size and colour of hind wing. *M. r. radiata* is smaller (fore wing length 10·6 mm in *radiata*, 11·0–15·4 mm in *terracotta*) with brown hind wings; the hind wings of *M. r. terracotta* are white or greyish to brownish orange. The males of the two subspecies can be distinguished on the closeness of the scobinate bar spicules: overlapping in *M. r. radiata*, non-overlapping in *M. r. terracotta*.

Masalia radiata terracotta Hampson **stat. n.**

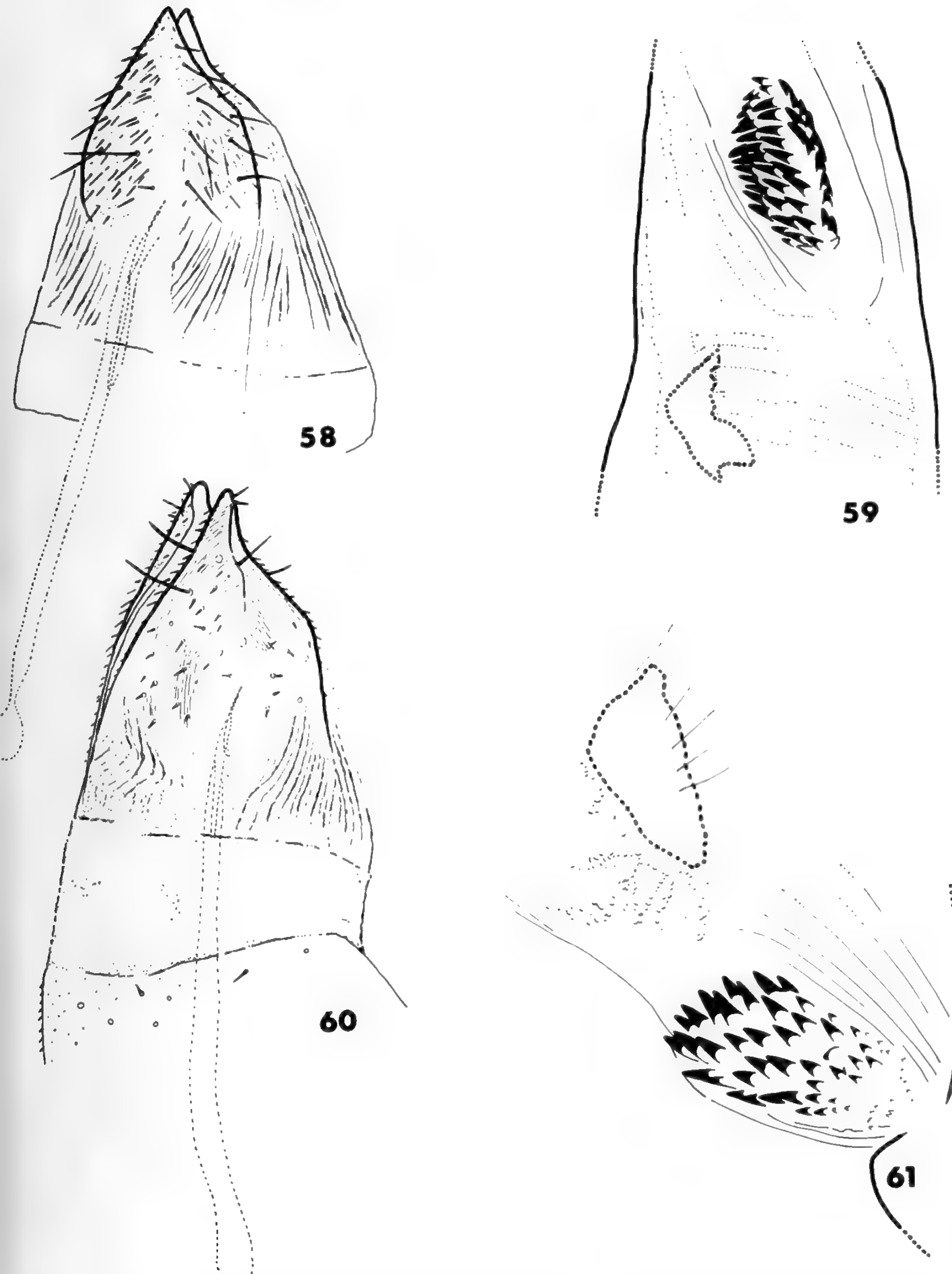
(Text-figs 58, 60, 61; Pl. 4, figs 156–158)

Masalia terracotta Hampson, 1891 : 71. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].

Timora flavia Hampson, 1903 : 113. LECTOTYPE ♂, INDIA (BMNH), here designated [examined]. **Syn. n.**

Fore wing with or without areole; length ♂ (32), 11·0–13·5 (lectotype), ♀ (15), 12·2–15·4. Wing pattern as in Pl. 4, figs 156–158. Fore wing upper surface with ground colour pale yellow or light to brownish orange. Upper central longitudinal streak white. In specimens with pale yellow grounds, the upper central longitudinal streak may be outlined or partly outlined in greyish red or light brown. Hind wing upper surface white or greyish to brownish orange.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 61. ♀ papilla analis modified, terminal spines absent (Text-figs 58, 60).



FIGS 58–61. 58, *M. radiata terracotta*, ♀, papilla analis. 59, *M. r. radiata*, ♂, scobinate bar and cornutus. 60, *M. r. terracotta*, ♀, papilla analis. 61, *M. r. terracotta*, ♂, scobinate bar and cornutus.

MATERIAL EXAMINED.

Masalia terracotta, LECTOTYPE, here designated, [INDIA: Madras,] Nilgiris, ♂, paralectotypes, [INDIA: Madras,] Nilgiris, 1 ♂, 1 ♀. *Timora flavia*, LECTOTYPE, here designated, [INDIA: Mysore,] Belgaum, ♂, x.1896 (*Watson*); paralectotypes, (INDIA: Madhya Pradesh,] Mhow, 1 ♀, ix.1881 (*C. Swinhow*); [Mysore,] Belgaum, 1 ♀, ix.1896 (*Watson*); Deccan, 1 ♂ (*Sykes*); southern India, Wynád, 1 ♂.

INDIA: Maharashtra, Bombay, 3 ♂; M., Nasik, 3 ♂; Mysore, Belgaum, 1 ♂, 1 ♀, ix.1896; 2 ♂, 4 ♀ (*T. R. Bell*); Kerala, Peermade, 2 ♂, 1 ♀ (*Imray*); K., 1 ♂; southern India, 2 ♂ (*T. R. Bell*); Madras, Nilgiris, 3000 ft, 1 ♀ (*Hampson*); Madhya Pradesh, Mhow, 1 ♂, 2 ♀, ix.1881 (*C. Swinhoe*); West Bengal, Darjeeling, 1 ♀ (*Pilcher*); SIKKIM: 1 ♂, v.1893. 11 ♂, 2 ♀ specimens with localities indistinctly written.

DISTRIBUTION. India and Sikkim.

REMARKS. The two subspecies can be separated on difference in size and hind wing colour: *M. r. terracotta* is larger (compare fore wing length) with white or greyish to brownish orange hind wings; the hind wings in *M. r. radiata* are brown. Non-overlapping scobinate bar spicules in the male of *M. r. terracotta*, contrasted with the overlapping spicules in *M. r. radiata*, also distinguish between them.

Masalia rubristria (Hampson) **comb. n.**

(Text-figs 62–64; Pl. 5, figs 162–170; Map 7)

Timora rubristria Hampson, 1903 : 112.

M. rubristria is a variable species both in colour and marking, closely allied to *M. epimethea* and *M. beatrix*. The species is divided into three subspecies. Of these three, two (*M. r. rubristria* and *M. r. transvaalica*) have no areole and, on the absence of this character, are separated from *M. epimethea* and *M. beatrix*. The third subspecies, in which an areole is present, *M. r. rhodomelaleuca*, can be distinguished from *M. epimethea* and *M. beatrix* on differences in fore wing colour.

M. rubristria can be separated from the remaining species in the *radiata*-group (the only others in the genus likely to be confused with it) by the form of the female papilla analis, simple in *M. rubristria*, modified in *M. flavistrigata*, *M. radiata*, *M. rosacea* and *M. roseivena*.

Differences occur between monomorphs from a number of localities; the similarity of monomorphs from others, and from at least one locality the occurrence together of dimorphs, each variant known from at least one other locality as a monomorph (see under discussion of *M. r. rubristria*), cannot be satisfactorily resolved without further material and investigation. The tentative division of the material into three subspecies is primarily based on geographic separation of the known material. Structurally however, on the presence of an areole, *M. r. rhodomelaleuca* can be separated from subspecies *rubristria* and *transvaalica*. *M. r. rubistria* and *M. r. transvaalica* differ in the colour of their fore wing markings, light brown, brownish

or reddish brown in *rubristria*, pale to pastel or greyish red in *transvaalica*. Specimens which are not clearly recognized on colour may be separated on size; of the two, *transvaalica* is larger though the ranges of the two subspecies do overlap.

Masalia rubristria rubristria (Hampson)

(Text-figs 62, 63; Pl. 5, figs 162–165; Map 7)

Timora rubristria Hampson, 1903 : 112. Holotype ♂, NIGERIA (BMNH) [examined].
Timora multistriata Bethune-Baker, 1911 : 507. LECTOTYPE ♂, NIGERIA (BMNH), here designated [examined]. **Syn. n.**
Timora sanguistria Berio, 1966 : 111. Holotype ♂, SENEGAL (MNHN, Paris) [examined]. **Syn. n.**

Fore wing without areole; length ♂ (32), 11·4–15·3 (holotype 11·9), ♀ (20), 11·9–16·2. Wing pattern as in Pl. 5, figs 162–165. Fore wing upper surface with pattern and colouring variablein ; Pl. 5, figs 162, 163, 164, central and anal regions white with white-brown, brown, or reddish brown markings; costal region either yellowish white, pale yellow, light brown or brown; in Pl. 5, fig. 165, ground colour pale yellow, upper central and anal longitudinal streaks white, outlined with greyish rose. Hind wing upper surface white, marginally irrorate with light brown, or light brown (*sanguistria* holotype).

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 62, 63. ♀ papilla analis simple.

MATERIAL EXAMINED.

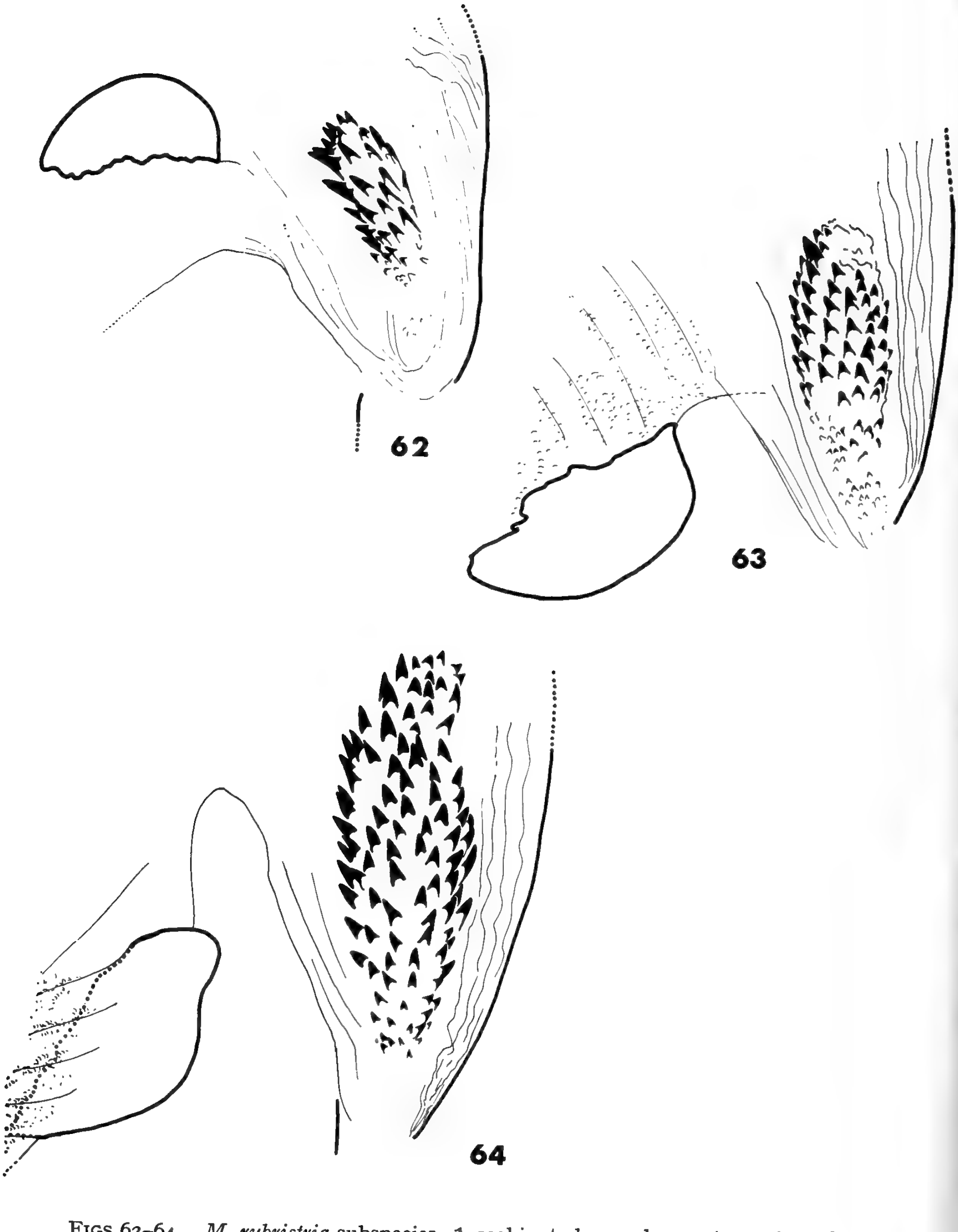
Timora rubristria, holotype, NIGERIA: Asaba, ♂ (*Crosse*). *Timora multistriata*, LECTOTYPE, here designated, NIGERIA: 100 miles north of Lokoja, ♂ (*D. Cator*). *Timora sanguistria*, Holotype, SENEGAL: Badi, ♂ [Institut français d'Afrique noire Dakar (Senegal)], MNHN, Paris.

SENEGAL: Kaolack, 1 ♂ (*G. du Dresnay*), in MNHN, Paris; 1 ♂ (*LeMoult*); GUINEA: Diondougou, 1 ♂ (*L. J. De Joannis*), in MNHN, Paris; GHANA: Gambaga, 11 ♂, 11 ♀ (*Bury*); Kete-Krachi, 6 ♂, 5 ♀ (*A. W. Cardinall*); [Nararo] Navaro, 2 ♂ (*A. W. Cardinall*); NIGERIA: Ogruga [?Ogrugru], River Niger, 1 ♀; Baro, 1 ♀, 25.ix.1910 (*Scott Macfie*); Minna, 2 ♂, 1.x.1910 (*Scott Macfie*); 100 miles north of Lokoja, 1 ♂ (*D. Cator*); CENTRAL AFRICAN REPUBLIC: Fort Crampel, 3 ♂, 2 ♀ (*LeMoult*).

DISTRIBUTION (Map 7). Senegal, Guinea, Ghana, Nigeria and Central African Republic.

REMARKS. The absence of an areole and the brown or reddish brown fore wing markings in *M. r. rubristria* separate it from *M. r. rhodomelaleuca* (areole present) and *M. r. transvaalica* (fore wing pale, pastel-, or greyish red), respectively.

Specimens similar to the lightly marked one from Guinea are known from Minna (Nigeria) and Nararo (Ghana) (Text-fig. 165). A second variant (Text-fig. 162) is also known from this latter locality. Specimens from Fort Crampel (Central African Republic), Kete Krachi (Ghana) and Gambaga (Ghana) are essentially alike. Fort Crampel specimens are larger and have slightly wider, white longitudinal streaks. Of the remaining material variation occurs from locality to locality.



FIGS 62–64. *M. rubristria* subspecies, ♂, scobinate bar and cornutus. 62 and 63, *M. r. rubristria*. 64, *M. r. transvaalica*.

Masalia rubristria transvaalica (Distant) **comb. et stat. n.**

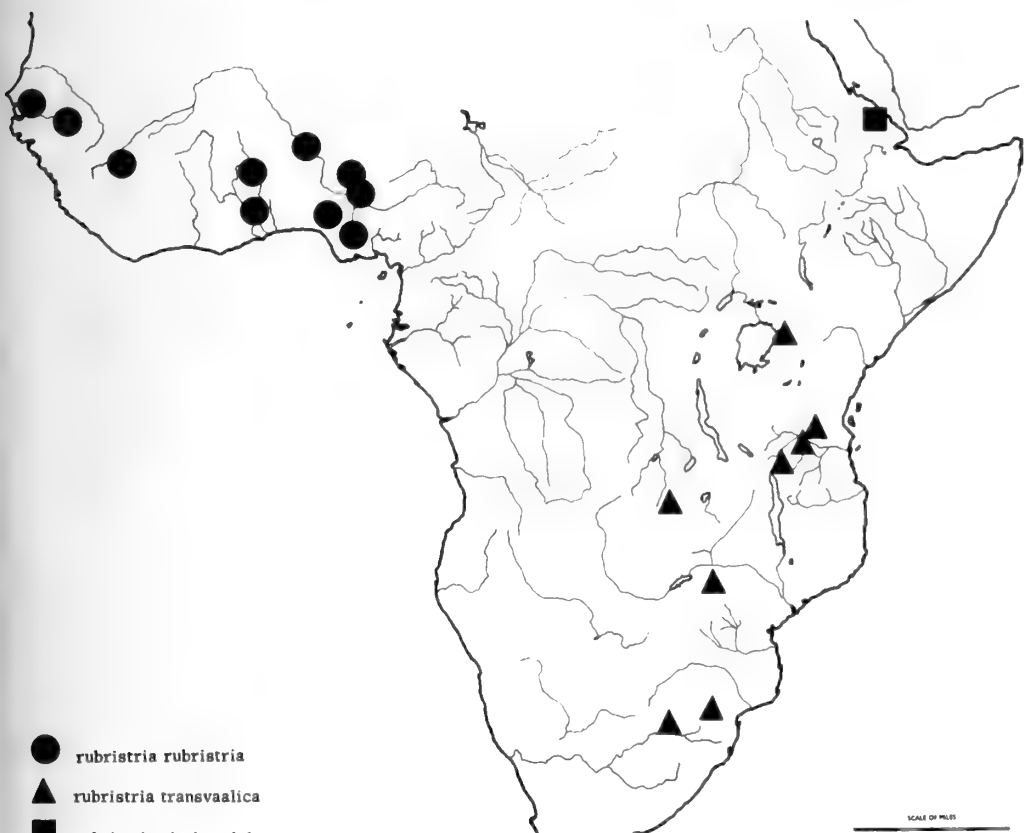
(Text-fig. 64; Pl. 5, figs 166–169; Map 7)

Timora transvaalica Distant, 1902 : 212. LECTOTYPE ♂, South Africa (BMNH), here designated [examined].

Timora rosea Gaede, 1915 : 39. LECTOTYPE ♂, South Africa (MNHU, Berlin), here designated [examined]. **Syn. n.**

Fore wing without areole; length ♂ (21), 13·8–17·5 (lectotype 17·3), ♀ (4), 15·8–17·8. Wing pattern as in Pl. 5, figs 166–169. Fore wing upper surface with pattern and colouring variable: in Pl. 5, figs 166, 167, ground colour pale to pastel-red, occasionally with a number of veins lightly outlined in brown, upper central and anal longitudinal streaks (when present) white; in Pl. 5, figs 168, 169, ground colour yellowish white to pale yellow, radial, medial, cubital and anal veins outlined in pastel to greyish red. Hind wing upper surface white, pale to pastel-red, or light brown to brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 64. ♀ papilla analis simple.



Map 7. Distribution of subspecies of *M. rubristria*.

MATERIAL EXAMINED.

Timora transvaalica, LECTOTYPE, here designated, [SOUTH AFRICA:] Transvaal, Johannesburg, ♂ (*J. Hyde*); *Timora rosea*, LECTOTYPE, here designated, [SOUTH AFRICA:] Transvaal, White River, ♂, ii.1911 (*A. T. Cooke*), in MNHU, Berlin.

KENYA: Kavirondo, Suna, 10 ♂, iii.1931; 3 ♂, iv.1931; 1 ♂, xi.1931; 1 ♂, ii.1932; TANZANIA: Kalambo River, 1 ♀; Kilossa, 1 ♂, 28.iii.1922; Njombe, 6000–6500 ft, 1 ♂, 19.ii.1952 (*W. Peters*); CONGO (KINSHASA): Elisabethville, 2 ♂, 3, 5.iii.1949 (*Ch. Seydel*), in MRAC, Tervuren; ZAMBIA: Kapapi, 1 ♂, 17.iii.1939 (*F. B. Macrae*); RHODESIA: Sinoia, 1 ♂, 21.ii.1950 (*N. Mitton*); SOUTH AFRICA: Transvaal White River, 1 ♂, 10.i.1910 (*A. T. Cook*); 2 ♀ (*C. H. Pead*).

DISTRIBUTION (Map 7). Kenya, Tanzania, Congo (Kinshasa), Zambia, Rhodesia and South Africa.

REMARKS. The absence of an areole from *M. r. transvaalica* separates it from *M. r. rhodomelaleuca*; *M. r. transvaalica* and *M. r. rubristria* are fairly readily distinguished on the colour difference of the fore wing markings, pale, pastel to greyish red in *M. r. transvaalica*, brown or red in *M. r. rubristria*.

Across the range of *M. r. transvaalica* differences in colour and pattern occur in a number of localities.

Masalia rubristria rhodomelaleuca (Berio) **comb. et stat. n.**

(Pl. 5, fig. 170; Map 7)

Timora rhodomelaleuca Berio, 1943 : 182. Holotype ♂, ETHIOPIA: Elaberet, 17.ix.1938 (*G. Vaccaro*) (Berio Coll., MCSN, Genoa).

Fore wing with areole; length ♀ (1), 15·4. Wing pattern as in Pl. 5, fig. 170. Fore wing upper surface with costal and anal regions light to greyish orange; central region with proximal and disto-radial areas brown, disto-cubital area light to greyish orange; upper central longitudinal streak white. Hind wing upper surface light to yellowish brown.

Genitalia. ♀ papilla analis simple.

MATERIAL EXAMINED.

[Paratype] allotype, [ETHIOPIA] Eritrea: Elaberet, ♀, 1.ix.1938 (*F. Vaccaro*), in MCSN, Genoa.

DISTRIBUTION (Map 7). Ethiopia.

REMARKS. The presence of the areole in *M. r. rhodomelaleuca* distinguishes it from both *M. r. transvaalica* and the nominate subspecies.

Masalia beatrix (Moore) **comb. n.**

(Text-figs 65–66; Pl. 6, figs 174–178)

Pradatta beatrix Moore, 1881 : 365.

Fore wing with areole.

Two subspecies are recognized, *beatrix* from India and *trifasciata* from Africa. Whilst the fore wing pattern in the African subspecies is fairly constant, that of the

Indian subspecies is variable and makes separation of the two difficult. The fore wing central region in *M. b. trifasciata* differs in colour from the costal and anal regions and is clearly deliminated from them; there is always a well differentiated brown to dark brown lower central longitudinal streak. In *M. b. beatrix* the central region is similarly coloured to the costal and anal regions and with incursion of colour from these outer regions, the central region is not clearly deliminated. The lower central longitudinal streak, when present, ranges from light orange to pastel-red. Occasionally it is suffused with brown but in contrast to the brown streak in *M. b. trifasciata*, any brown marking present is narrow and poorly defined.

M. beatrix is distinguishable from other species in the *radiata*-group on genitalic characters. The simple form of the papilla analis in *M. beatrix* separates it from *M. flavistrigata*, *M. radiata*, *M. rosacea* and *M. roseivena*; in the latter four, the papilla analis is modified. Overlapping scobinate bar spicules in *M. beatrix* separate it from the remaining two species, the African *M. rubristria* and the Madagascan *M. epimethea;* in M. *rubristria* and *M. epimethea* the spicules are non-overlapping.

Masalia beatrix beatrix (Moore)

(Text-fig. 65; Pl. 6, figs 174–176)

Pradatta beatrix Moore, 1881 : 365. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].
Timora beatrix (Moore) Hampson, 1903 : 114.
Timora nigristriata Hampson, 1903 : 110. Holotype ♂, INDIA (BMNH) [examined]. **Syn. n.**

Fore wing, length ♂ (12), 12·9–14·9 (lectotype 14·2), ♀ (17), 12·6–15·4. Wing pattern as in Pl. 6, figs 174–176. Fore wing upper surface with costal and anal regions orange-white to light orange or reddish white to pastel-red, central region white to yellowish white, streaked with the same colour as the costal and anal regions and with costal and anal region colouring extending in from these regions. Depending upon incursion of colour and extent of streaking a lower, central, longitudinal streak may be differentiated; when present the streak is immaculate or irrorate with light brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 65. ♀ papilla analis simple.

MATERIAL EXAMINED.

Pradatta beatrix, LECTOTYPE, here designated, [INDIA: Punjab,] Dharmsala, ♂ (*Hocking*); paralectotypes, [INDIA: Punjab,] Dharmsala, 2 ♂, 2 ♀ (*Hocking*); *Timora nigristriata*, holotype [INDIA: Mysore,] Belgaum, ♂, ix.1896 (*E. Watson*).

INDIA: Rajasthan, Ajmer, 1 ♂, 28.vii.1892; 1 ♂, 4.viii.1892; 1 ♀, 10.viii.1992; Himachal Pradesh, Mandi, 3–5000 ft, 1 ♀, 1883 (*G. Young*); H. P., Kangra, 1 ♀, 1884; N.W. Himalaya, 1 ♂; Maharashtra, Nasik, 1 ♂, 4 ♀, ix.1892; M., Nagpur, Chota, 1 ♀, 1911; Kerala, Peermade, 1 ♂ (*Imray*); K., 1 ♂, 1 ♀ (*Place*); southern India, 1 ♀ (*T. R. Bell*); Madras, Cuddapah, 1 ♂ (*Campbell*); M., Nilgiri Hills, 1 ♀; ?, Simla, 7000 ft, 1 ♀ (*A. E. Jones*); West Bengal, Darjeeling, 1 ♂ (*Pilcher*); 1 ♀ (*C. R. Oakes*).

DISTRIBUTION. India.

REMARKS. The absence of a brown lower central longitudinal streak (or at most

presence of a streak irrorate with brown and forming a fine brown streak within the longitudinal streak) distinguishes *M. b. beatrix* from *M. b. trifasciata*. In *M. b. trifasciata* the lower central longitudinal streak is always well defined and brown to dark brown in colour.

Masalia beatrix trifasciata (Hampson) **comb. et stat. n.**

(Text-fig. 66; Pl. 6, figs 177, 178)

Timora trifasciata Hampson, 1903 : 110. Holotype ♀, KENYA (BMNH) [examined].

Fore wing, length ♂ (10), 14·2–15·8, ♀ (15), 15·0 (holotype)–16·4 (5). Wing pattern as in Pl. 6, figs 177, 178. Fore wing upper surface with costal and anal regions from pastel to greyish red; anal region lightly to moderately irrorate with dark brown. Central region white to orange-white. Lower central, and longitudinal streak between R_5–M_1, dark brown; R_5–M_1 streak faintly to well developed. Hind wing upper surface white to orange-white, distally light to moderately irrorate with brown.

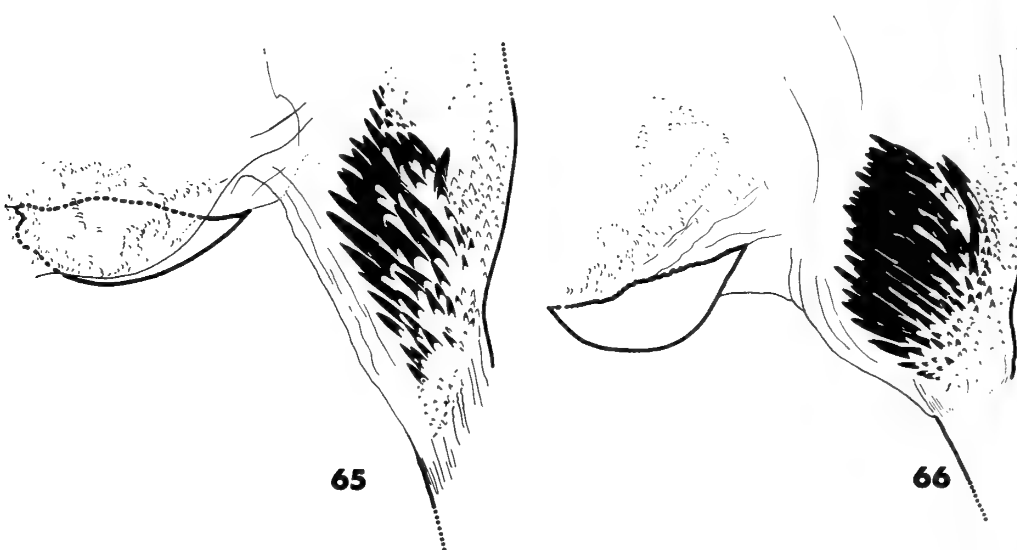
Genitalia. ♂ scobinate bar and cornutus (Text-fig. 66). ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype [KENYA] B. E. Africa: [Stony Athi, River Athi,] Stony River, ♀, 2.xii.1898 (*R. Crawshay*).

KENYA: Kavirondo, 1 ♂, 1 ♀, iii.1931 (*W. Feather*); 1 ♂, iv.1932 (*W. Feather*); Kibwezi, 1 ♂, iii.1922 (*W. Feather*); TANZANIA: Musoma, Banagi Hill, 1 ♂, 1 ♀ (*M. S. Moore*); Shinyanga, Mwandui, 1 ♂, xii.1951; 1 ♂, i.1952; 1 ♂, 1 ♀, ii–iii.1952; 1 ♂, iii.1952 (all *Croft*).

DISTRIBUTION. Kenya and Tanzania.



FIGS 65–66. *M. beatrix* subspecies, ♂, scobinate bar and cornutus. 65, *M. b. beatrix*. 66, *M. b. trifasciata*.

REMARKS. The presence of a pronounced brown lower longitudinal streak in *M. b. trifasciata* distinguishes it from *M. b. beatrix*. When present, the streak in *M. b. beatrix* is of orange or red colour, occasionally irrorate with brown. A brown streak may be formed through dense irroration but in those specimens in which this occurs, the streak is always set within a wider streak of orange or red; in *M. b. trifasciata* the central longitudinal streak is unicolorous.

Masalia epimethea (Viette) **comb. n.**

(Text-fig. 67; Pl. 4, figs 160, 161)

Timora epimethea Viette, 1958 : 149. Holotype ♀, MADAGASCAR: centre, district de Fianarantsao, Ambalavao, iii.1956 (*A. Robinson*) (MNHN, Paris).

Fore wing with areole; length ♂ (9), 13·0–15·0, ♀ (10), 14·2–15·7. Wing pattern as in Pl. 4, figs 160, 161. Fore wing upper surface with ground colour brownish orange, costal margin and upper central longitudinal streak white. In a few specimens there is a white longitudinal streak between M_3–Cu_{1a}. When present, terminal and medial dots brown. Hind wing upper surface with proximal area either white or light brown; when white, the distal area is light brown; when light brown, the distal area is brown; marginal 'cilia' white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 67. ♀ papilla analis simple.

MATERIAL EXAMINED.

MADAGASCAR: 1 ♂, 9 ♀; de Fianarantsae, 1 ♂, iii.1956 (*A. Robinson*), MNHN,

FIG. 67. *M. epimethea*, ♂, scobinate bar and cornutus.

Paris (this specimen was collected with the holotype but did not form part of the type-series—communication by Dr P. Viette); Mananjary, 7 ♂, 1 ♀, 1918 (*G. Melou*).

DISTRIBUTION. Madagascar.

REMARKS. Separation of *epimethea* from other species in the *radiata*-group involves a number of structural characters. The simple form of the papilla analis in *epimethea* separates it from *flavistrigata, radiata, roseivena* and *rosacea*; in the latter four, the papilla analis is modified. Non-overlapping scobinate bar spicules in *epimethea* separate it from *beatrix*, in which the spicules overlap; and the presence of an areole in *epimethea* distinguishes it from *rubristria*.

Masalia rosacea Hampson

(Text-figs 68, 69; Pl. 6, figs 179, 180)

Masalia rosacea Hampson, 1891 : 71. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].

[*Pradatta beatrix* Moore; Hampson, 1903 : 114. *M. rosacea* considered to be an aberration of *P. beatrix* Moore.]

Timora rosacea (Hampson) Warren, 1913 : 315. [Reinstated as valid name.]

Fore wing with areole; length ♂ (7), 13·4 (lectotype)–15·9, ♀ (2), 16·1–16·5. Wing pattern as in Pl. 6, figs 179, 180. Fore wing upper surface with ground colour pale to pastel-red, upper central longitudinal streak white to yellowish white. Hind wing upper surface reddish golden brownish orange.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 69. ♀ papilla analis modified, terminal spines present (Text-fig. 68).

MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA: Madras,] Nilgiris, ♂ (*Hampson*); paralectotypes, [INDIA: Madras,] Nilgiris, 3 ♂ (*Hampson*).

INDIA: Kerala, 1 ♂ (*Place*); K., Peermade, 1 ♂, 1 ♀ (*Imray*); Madras, Nilgiris, 1 ♂, 7.ix.1903 (*Hampson*); ?, Seven Valley, 1 ♀.

DISTRIBUTION. Southern India.

REMARKS. Within the *radiata*-group *rosacea* is separable from all but *roseivena* on features of the papilla analis. The modified form of the papilla analis in *rosacea* separates it from *beatrix, epimethea* and *rubristria* (simple in these three); and the presence of terminal spines separates it from *flavistrigata* and *radiata*; in *flavistrigata* and *radiata*, terminal spines are absent. *M. rosacea* is distinguishable from *roseivena* on the difference in the upper surface hind wing colour, reddish golden brownish orange in *rosacea*, white either immaculate or lightly suffused with reddish brown in *roseivena*.

Masalia roseivena (Walker) **comb. n.**

(Text-figs. 70, 71; Pl. 6, figs 181–184)

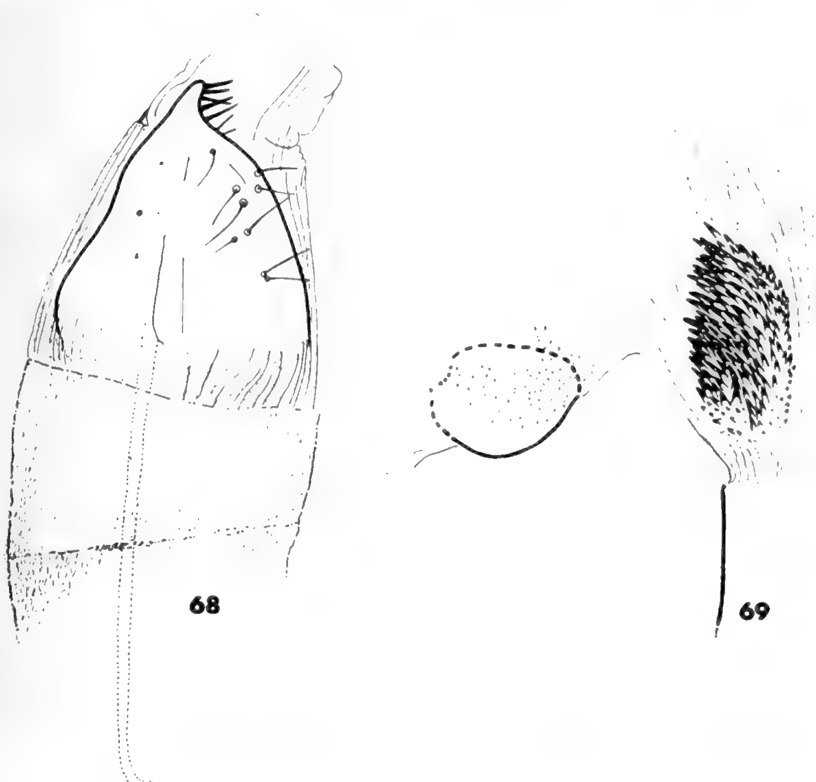
Leucania roseivena Walker, 1866 : 1954. Holotype ♂, FLORES (UM, Oxford) [examined].
Timora roseivena (Walker) Warren, 1913 : 314.
Leucania alarioides Butler, 1886 : 392. Lectotype ♂, AUSTRALIA (BMNH) [examined.] [Synonymized by Warren, 1913 : 314.]
Timora alarioides (Butler) Hampson, 1903 : 111. [Lectotype designated.]

Fore wing with areole present; length ♂ (8), 12·2–14·8 (holotype), ♀ (10), 13·9–15·4. Wing pattern as in Pl. 6, figs 181–184. Fore wing upper surface with costal and anal regions pink, central region white; lower central longitudinal streak pink, either immaculate or suffused with reddish brown. Hind wing upper surface white, immaculate or lightly suffused with reddish brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 71. ♀ papilla analis modified, terminal spines present (Text-fig. 70).

MATERIAL EXAMINED.

Leucania roseivena, holotype, FLORES: ♂ (*Wallace*), in UM Oxford; *Leucania*



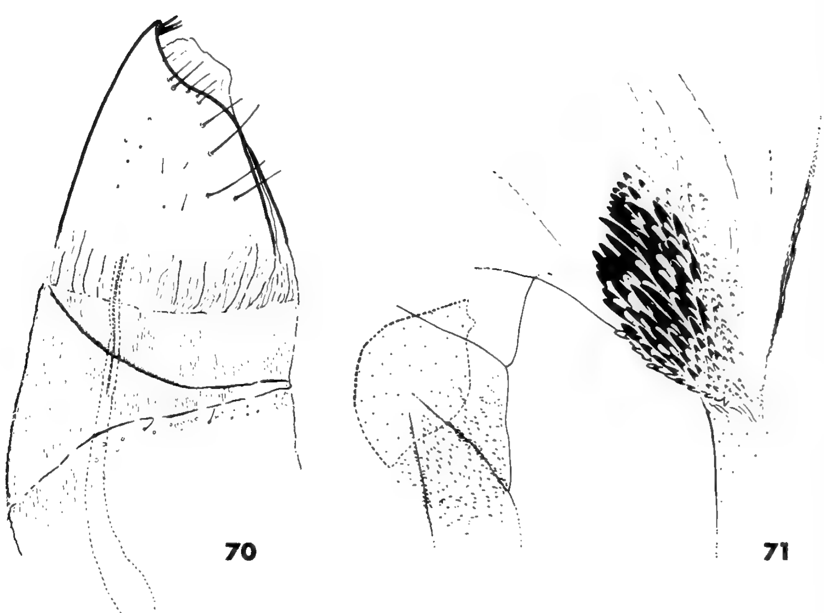
FIGS 68–69. *M. rosacea*, genitalia. 68, ♀, papilla analis. 69, ♂, scobinate bar and cornutus.

alarioides, lectotype [AUSTRALIA:] Queensland, Peak Downs, ♂; paralectotype [AUSTRALIA: Queensland,] Gayndah, ♂.

LOMBOK: Pringabaja, 1 ♀, iv.1896 (*H. Frashstorfer*); AUSTRALIA: Northern Territories, Darwin, 2 ♀ (*J. S. Litchfield*); Eureke, 2 ♂, 4 ♀, ii.1903 (*Tunney*); Queensland, Geraldtown, near Cairns, 1 ♂ (*Meek*); Mareeba, 1 ♂, 25.xii.1961 (*H. Demarz*), in ZSBS, Munich; Peak Downs, 1 ♂; Townsville, 1 ♀ (*Dodd*); [?,] 2 ♀ (*Barnard*).

DISTRIBUTION. Lombok, Flores and Australia.

REMARKS. Apart from *rosacea, roseivena* can be separated from all other species in the *radiata*-group on characters of the female genitalia, the modified form of the papilla analis and presence of terminal spines. In *beatrix, epimethea* and *rubristria* the papilla anali are simple in form; *flavistrigata* and *radiata* both have modified papilla anali but terminal spines are absent. *M. roseivena* is distinguishable from *rosacea* on the colour difference of the hind wing upper surface: white, either immaculate or lightly suffused with reddish brown in *roseivena*, reddish golden brownish orange in *rosacea*.



FIGS 70–71. *M. roseivena*, genitalia. 70, ♀, papilla analis. 71, ♂, scobinate bar and cornutus.

Masalia flavistrigata (Hampson) **comb. n.**

(Text-figs 72, 73; Pl. 7, figs 186–188)

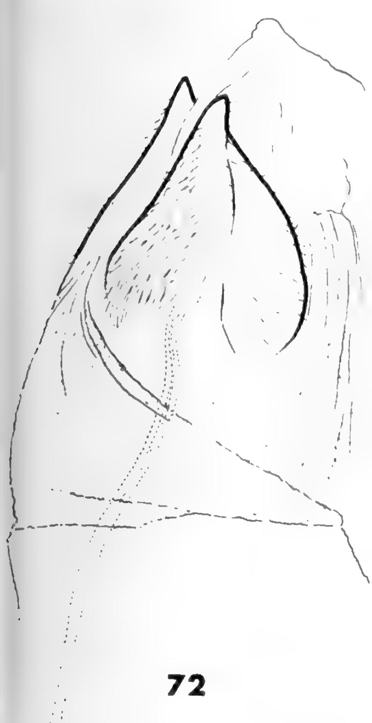
Timora flavistrigata Hampson, 1903 : 114. Holotype ♂, KENYA (BMNH) [examined].
Timora lineata de Joannis, 1910 : 224. LECTOTYPE ♂, GUINEA (MNHN, Paris), here designated [examined]. **Syn. n.**

Prothoracic tibia with outer claw short or absent. Fore wing with areole; length ♂ (168) 11·4–16·5 (lectotype 13·4), ♀ (29), 12·4–18·2. Wing pattern as in Pl. 7, figs 186–188. Fore wing upper surface with ground colour ranging from pale to greyish orange, or pastel-red through brownish orange to dull red. Upper central longitudinal streak, when present, yellowish white. Anal region immaculate or lightly suffused with greyish brown. Hind wing upper surface white to yellowish white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 73. ♀ papilla analis modified, dorsolateral surface clothed in fine hair, terminal spines absent (Text-fig. 72).

MATERIAL EXAMINED.

Timora flavistrigata, holotype [KENYA:] Nairobi Plains, Kikuyu, ♂ (*R. Crawshay*). *Timora lineata*, LECTOTYPE, here designated, [GUINEA] H. Guinea: Siguiri, Oudoula, ♂, in MNHN, Paris.



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FIGS 72–73. *M. flavistrigata*, genitalia. 72, ♀, papilla analis. 73, ♂, scobinate bar and cornutus.

GHANA: Northern Territories, Kete-Krachi, 9 ♂, 6 ♀ (*A. W. Cardinall*); NIGERIA: Minna, 1 ♀, 6.x.1910 (*Scott-Macfie*); CENTRAL AFRICAN REPUBLIC: Fort Crampel, 1 ♂ (*LeMoult*); ANGOLA: Luimbale, Mt. Moco, 1800–1900 m, 122 ♂, 14 ♀, 15–24.iii. 1934 (*K. Jordan*); Lunda, Xa-Sengue, 2 ♂, 9.iv.1937 (*M. A. Exwell*); Quicolungo, 120 km north of Lucala, 2 ♂, iv.1936 (*R. Braun*); ETHIOPIA: Harar, 1 ♂, viii.1939 (*R. E. Ellison*); UGANDA: Mulema, 2 ♂, 1 ♀, v.1903 (*W. L. Doggett*); S. E. Ruwenzori, 3500 ft, 1 ♂, 16.iv.1906 (*G. Legge & A. E. R. Wollaston*); KENYA: Kitale, 14 ♂, 2 ♀, vi–vii.1934 (*G. W. Jeffery*); Lumba, 1 ♂, 2.iv.1923 (*G. W. Jeffery*); Mt. Elgon, 1 ♀, iv.1932 (*T. H. E. Jackson*); TANZANIA: Dodoma, 1 ♀, iii.1950 (*N. Mitton*); Marungu Plateau, 7000 ft, 1 ♂, ii.1922 (*T. A. Barns*); MALAWI: Mt. Mlanje, 1 ♂, 24.iv.1923 (*S. A. Neave*); ZAMBIA: Abercorn, 1 ♂, ii.iii.1954 (*D. Vesey-Fitzgerald*).

DISTRIBUTION. Guinea, Ghana, Nigeria, Central African Republic, Angola, Ethiopia, Uganda, Kenya, Tanzania, Malawi, Zambia, South Africa.

REMARKS. Within the *radiata*-group *flavistrigata* can be separated from all but *radiata* on differences in the female genitalia. The modified papilla analis in *flavistrigata* separates it from *beatrix*, *epimethea* and *rubristria*, in which the papilla analis is simple; the absence of terminal spines in *flavistrigata* separates it from *roseivena* and *rosacea*, both of which possess terminal spines. Although the relationship between *flavistrigata* and *radiata* is probably no closer than their relationship to any other species in the group, no single character has been found to separate *flavistrigata* from *radiata*. The white upper surface of the hind wing and the overlapping scobinate bar spicules in *flavistrigata* can, however, be used to separate *flavistriata* from each of the subspecies of *radiata*: in *M. r. radiata* the upper surface hind wing colour is brown, and in *M. r. terracotta* the scobinate bar spicules do not overlap.

THE *LATINIGRA–CHEESMANAE* COMPLEX

Affinities with other species in the genus are not particularly close. *M. latinigra* and *M. cheesmanae* can be separated from all but one other species, *M. flavistrigata*, by the presence of a single prothoracic claw; *latinigra* and *cheesmanae* are separable from *flavistrigata* by the more rounded fore wing apex (Text-figs 23 *flavistrigata*, 75) and the more elongate scobinate bar (Text-figs 73 *flavistrigata*, 73, 78, 80, 81).

Two closely related species are recognized, each with two subspecies. The species can be separated on differences in the male antennal segments, lamellate in *latinigra*, simple in *cheesmanae*. On colour and pattern the nominate subspecies are readily distinguished from one another but differences between subspecies *M. latinigra dangilensis* and *M. cheesmanae tamburensis* are less marked.

Masalia latinigra (Hampson) **comb. n.**

(Text-figs 74–78; Pl. 7, figs 189–191; Map 8)

Timora latinigra Hampson, 1907 : 243.

Antennal flagellar segments show marked sexual dimorphism: ♂ segments lamellate (atypical for genus), ♀ segments simple (Text-figs 76, 77). Prothoracic tibia with one inner claw (Text-fig. 74). Fore wing with areole of large size (Text-fig. 75).

Genitalia, ♂ scobinate bar markedly elongate (Text-fig. 78). ♀ papilla analis simple.

The lamellate antennae of the male are diagnostic.

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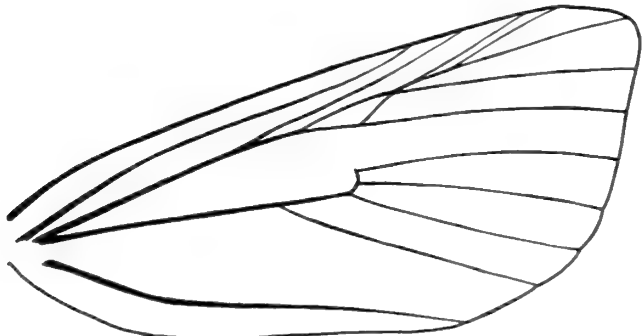

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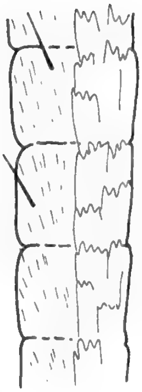

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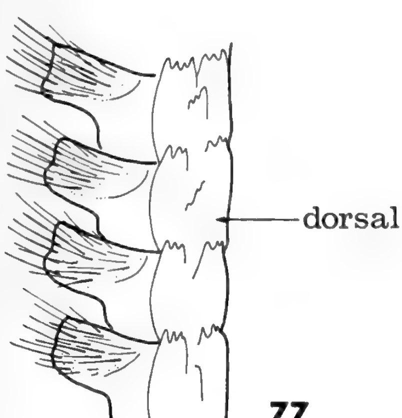

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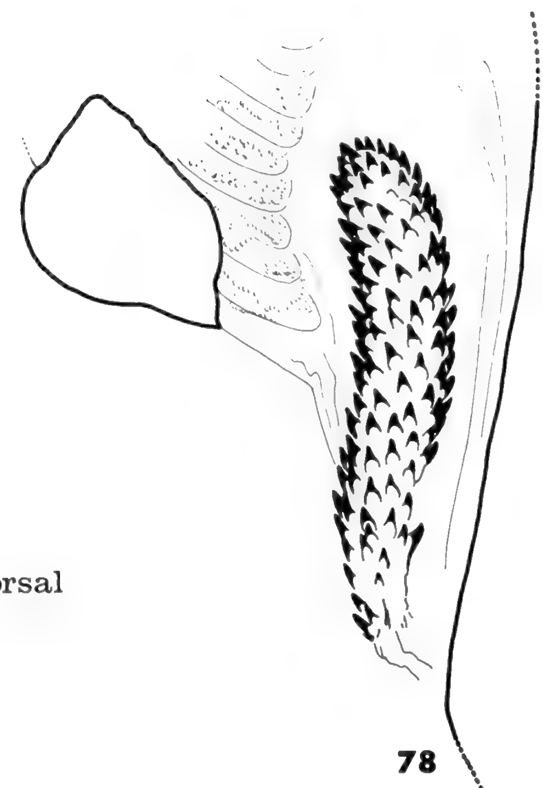

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FIGS 74–78. *M. latinigra*. 74, prothoracic tibia. 75, fore wing venation. 76, ♀, antennal segments, lateral view. 77, ♂, antennal segments, lateral view. 78, *M. l. latinigra*, ♂, scobinate bar and cornutus.

Masalia latinigra latinigra (Hampson)

(Text-fig. 78; Pl. 7, figs 189, 190; Map 8)

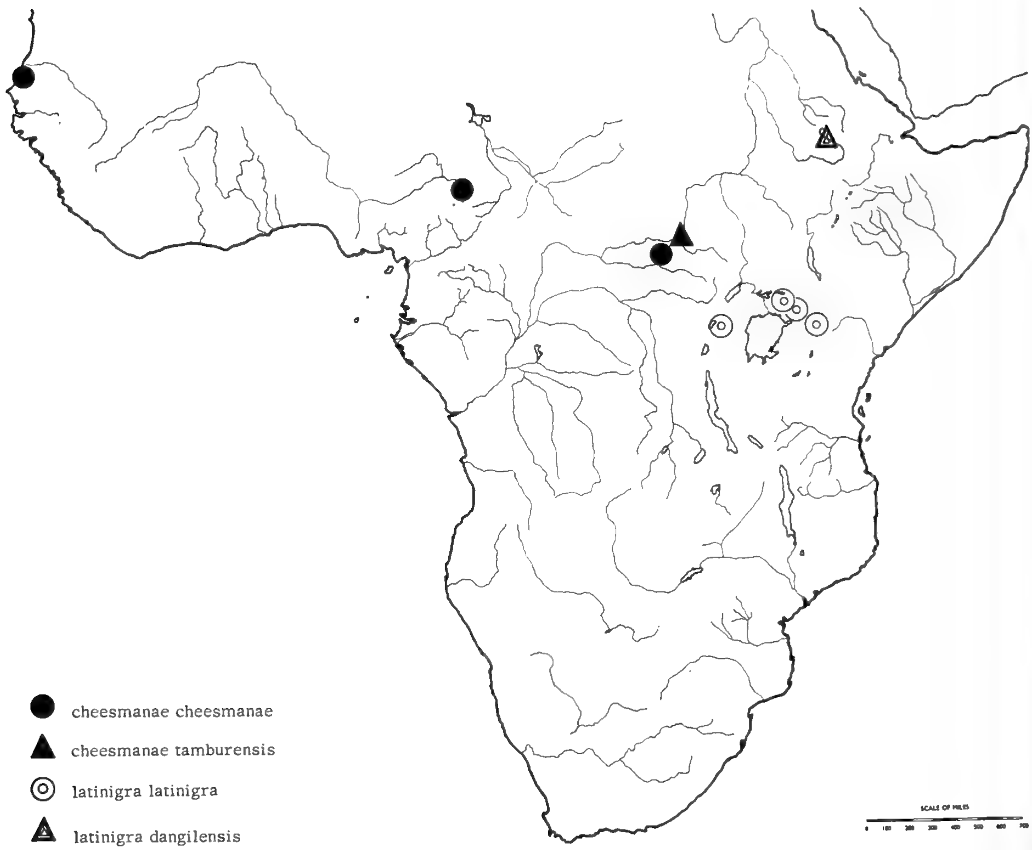
Timora latinigra Hampson, 1907 : 243. LECTOTYPE ♂, UGANDA (BMNH), here designated [examined].

Fore wing length ♂ (30), 12·9–15·8 (lectotype 14·1), ♀ (7), 13·2–15·3. Wing pattern as in Pl. 7, figs 189, 190. Fore wing upper surface with ground colour reddish yellow to light orange, lower central longitudinal streak, postmedial and terminal dots, dark brown to black. Hind wing upper surface yellowish white, finely to moderately irrorate with dark brown.

MATERIAL EXAMINED.

LECTOTYPE, here designated, UGANDA, ♂ (*W. L. Doggett*); paralectotypes, UGANDA, 16 ♂, 4 ♀ (*W. L. Doggett*).

UGANDA: Ankole, 2 ♂, 29.iii.–26.ix.1929 (*J. Gastrell*); Elburgin Railway Station, 2 ♂, 2.vii.1903; UGANDA-KENYA: Mt. Elgon, 1 ♂, v.1934 (*T. H. E. Jackson*); KENYA:



MAP 8. Distribution of species and subspecies of the *latinigra-cheesmanae* complex.

Kitali, 3 ♂, 1 ♀, 9–24.iv.1927; Nakuru, 1 ♀, 16.iv.1941; 3 ♂, 2 ♀, 5–22.iv.1942; 1 ♂, 11.v.1952; 1 ♀, 5.v.1954 (Nakuru specimens, *A. Townsend*).

DISTRIBUTION (Map 8). Uganda and Kenya.

REMARKS. The nominate subspecies is characterized by a well developed, broad, dark brown to black, lower central longitudinal streak; absent or poorly differentiated in *M. l. dangilensis.*

Masalia latinigra dangilensis subsp. n.

(Pl. 7, fig. 191; Map 8)

Fore wing length ♂ (15), 13·0–14·8 (holotype 13·8). Wing pattern as in Pl. 7, fig. 191. Fore wing upper surface with ground colour brownish orange, postmedial and terminal dots brown to dark brown; a brown, indistinctly differentiated, lower central longitudinal streak may be present. Hind wing upper surface brown.

MATERIAL EXAMINED.

Holotype, ETHIOPIA: Dangila, 40 mls S. of Lake Tana, 6700 ft, ♂, 31.viii.1926 (*R. E. Cheesman*).

Paratypes. ETHIOPIA: Dangila, 6700 ft, 14 ♂, 14–29.viii.1926 (*R. E. Cheesman*).

DISTRIBUTION (Map 8). Ethiopia.

REMARKS. The absence of a lower central longitudinal streak (or at the most the presence of a poorly differentiated one) distinguishes *M. l. dangilensis* from *M. l. latinigra.*

Masalia cheesmanae sp. n.

(Text-figs 79–81; Pl. 7, figs 192–194; Map 8)

Antenna with ♂ and ♀ flagellar segments simple. Prothoracic tibia with one inner modified spine. Fore wing with areole.

M. cheesmanae can be separated from *M. latinigra* on the difference in the male antennal segments, simple in *M. cheesmanae* (Text-fig. 79), lamellate in *M. latinigra* (Text-fig. 77).

This species is named after the late Miss L. Evelyn Cheesman, who collected much insect material for the BMNH.

Masalia cheesmanae cheesmanae subsp. n.

(Text-fig. 80; Pl. 7, figs 192, 193; Map 8)

Fore wing length ♂ (5), 12·2–14·4 (holotype 14·3). Wing pattern as in Pl. 7, figs 192–193. Fore wing upper surface with ground colour orange, costa white, markings brown. Hind wing upper surface yellowish white.

Genitalia. ♂ scobinate bar as in Text-fig. 80.

MATERIAL EXAMINED.

Holotype, [CONGO (KINSHASA):] Upper Uelle District, Dungu, ♂, v.

Paratypes. SENEGAL: St. Louis, 1 ♂, iii.1932, in MNHN, Paris; CAMEROUN:

Genderu Mountains, 2600 ft, 1 ♀, ix.1921; [CONGO (KINSHASA):] Upper Uelle District, Dungu, 2 ♂, ix.

DISTRIBUTION (Map 8). Senegal, Cameroun and Congo (Kinshasa).

REMARKS. *M. c. cheesmanae* can be separated from *M. c. tamburensis* on the difference in upper surface hind wing colour, yellowish white in *M. c. cheesmanae*, brownish orange in *M. c. tamburensis*.

***Masalia cheesmanae tamburensis* subsp. n.**

(Text-fig. 81; Pl. 7, fig. 194; Map 8)

Fore wing length, ♂ (1), 14·3 (holotype). Wing pattern as in Pl. 7, fig. 194. Fore wing upper surface with ground colour light orange, costa white, markings brown. Hind wing upper surface brownish orange.

Genitalia. ♂ scobinate bar as in Text-fig. 81.

MATERIAL EXAMINED.

Holotype, SUDAN: [Tambura] Tembura, ♂, viii [illegibly written].

DISTRIBUTION (Map 8). Southern Sudan.

REMARKS. *M. c. tamburensis* can be separated from the nominate subspecies on the difference in colour of the upper surface of the hind wing, brownish orange in *M. c. tamburensis*, yellowish white in *M. c. cheesmanae*.

***Masalia uncta* (Swinhoe) comb. n.**

(Text-fig. 82; Pl. 7, fig. 195)

Adisura uncta Swinhoe, 1885 : 449. LECTOTYPE ♂, INDIA (BMNH) [examined].
Timora uncta (Swinhoe) Hampson, 1903 : 109.

The species is known only from male specimens, and of the two referred to by Hampson, only one, labelled type, remains.

Fore wing with areole absent; length ♂ (1), 12·7 (lectotype). Wing pattern as in Pl. 7, fig. 195. Fore wing upper surface with ground colour light yellow; postmedial streaks on veins M_1 to Cu_{1a} brown; marginal cilia pale red, tipped with white. Hind wing upper surface brownish orange to light brown, streaked distally with light yellow; marginal cilia pale yellow.

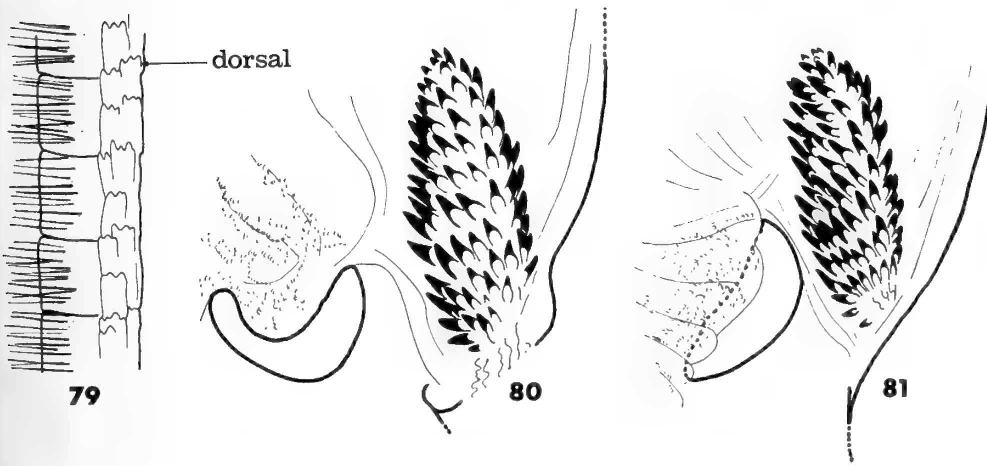
Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 82.

MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA: Maharashtra,] Bombay, ♂, x.1886 (*C. Swinhoe*).

DISTRIBUTION. South-west India.

REMARKS. The postmedial streaks against the light yellow ground of the fore wing, together with the absence of any other marking, distinguishes the species from others in the genus. On wing shape it is probably fairly closely allied to *M. albicilia*, and bears a marked resemblance to species within the genus *Adisura*.



FIGS 79–81. *M. cheesmanae*. 79, ♂, antennal segments, lateral view. 80, *M. c. cheesmanae*, ♂, scobinate bar and cornutus. 81, *M. c. tamburensis*, ♂, scobinate bar and cornutus.

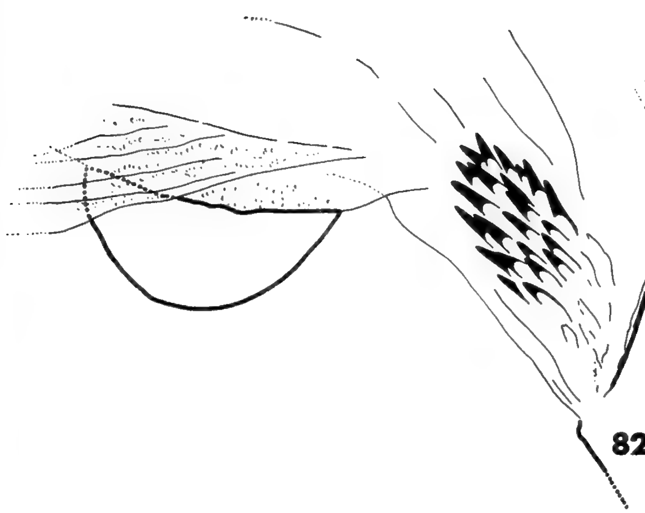


FIG. 82. *M. uncta*, ♂, scobinate bar and cornutus.

Masalia albicilia (Hampson) **comb. n.**

(Text-fig. 83; Pl. 7, figs 196, 197)

Timora albicilia Hampson, 1903 : 115. Holotype ♂, SIKKIM (BMNH) [examined].

Fore wing without areole; length ♂ (4), 11·8–12·2 (holotype 12·0), ♀ (2), 12·7–13·2. Wing pattern as in Pl. 7, figs 196, 197. Fore wing upper surface variable, light yellow suffused with brownish orange; outer margin brownish orange (Pl. 7, fig. 196), or brownish orange indistinctly marked with light yellow; outer margin brownish orange (Pl. 7, fig. 197). Marginal cilia white. Hind wing upper surface light brown, marginal cilia pale yellow.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 83. ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, SIKKIM: ♂, 3.x.1896 (*G. C. Dudgeon*).

INDIA: West Bengal, Darjeeling, Gopaldhara, 1 ♂; W.B., Darjeeling, Gopaldhara, 4720 ft, 1 ♂, 1 ♀, ix.1916; W.B., Darjeeling, Gopaldhara, 1 ♂, 18.ix.1916 (all *H. Stevens*); W.B., Darjeeling, 1 ♀.

DISTRIBUTION. North-east India and Sikkim.

REMARKS. The brownish orange colouring and virtual absence of pattern from the fore wing upper surface, together with the light brown colouring of the hind wing, distinguishes this species from others in the genus.

FIG. 83. *M. albicilia*, ♂, scobinate bar and cornutus.

Masalia albipuncta (Hampson) **comb. n.**

(Text-figs 26, 84; Pl. 8, figs 198, 199)

Timora albipuncta Hampson, 1910 : 401. LECTOTYPE ♂, ZAMBIA (BMNH), here designated [examined].

Fore wing with areole; length (10) ♂, 11·2 (lectotype)–13·8, ♀ (5), 12·0–14·4. Wing pattern as in Pl. 8, figs 198, 199. Fore wing upper surface with ground colour pale to light yellow. Terminal dashes, proximal oblique-longitudinal dash (Text-fig. 26), and, when present orbicular and discocellular markings, reddish brown to brown. A white waved postmedial band outlined in reddish brown or brown may also be present. Hind wing upper surface white, distally suffused with pale yellow or pale yellow and light brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 84. ♀ papilla analis simple.

MATERIAL EXAMINED.

LECTOTYPE, here designated, [ZAMBIA] North East Rhodesia: Upper Luangwa Valley, 1600–2000 ft, ♂, 21.iii.1908 (*S. A. Neave*); paralectotype, [ZAMBIA] North East Rhodesia: Upper Luangwa Valley, 1600–2000 ft, ♀, 16.iii.1908.

TANZANIA: Shinyanga, 1 ♂, iii.1952; 1 ♂, xii.1956; 4 ♂, 3 ♀, i.1957; 1 ♂, xi.1957 (all *Croft*); Shinyanga, Mwandui, 2 ♂, 1 ♀, ii.–iii.1952 (*Croft*).

DISTRIBUTION. Tanzania and Zambia.

REMARKS. Apart from *M. quilengesi*, *M. albipuncta* is readily distinguished from other species in the genus on wing colour and pattern. *M. albipuncta*, which could be confused with *M. quilengesi*, can be distinguished by the presence of a proximal oblique-longitudinal dash on the fore wing upper surface.

FIG. 84. *M. albipuncta*, ♂, scobinate bar and cornutus.

Masalia quilengesi sp. n.

(Text-fig. 85; Pl. 8, figs 200–202)

Fore wing with areole; length ♂ (2), 11·3 (holotype)–12·5, ♀ (2), 11·8–12·9. Wing pattern as in Pl. 8, figs 200–202. Fore wing upper surface with ground colour light yellow suffused with pale or pastel-red. Terminal dashes, orbicular and discocellular markings brown, one, two or all three markings may be absent but when present from faint to well developed. A postmedial row of white dots, lightly differentiated, may also be present. Hind wing upper surface pale yellow. In a male specimen from Okahandja (Pl. 8, fig. 202), a distinct variant, the costa region is light yellow, central and anal regions greyish red and ante- and postmedial markings white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 85. ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, [ANGOLA:] Benguella, Fort Quilenges, ♂, ii.1905 (*Ansorge*).

Paratypes. [ANGOLA:] Benguella, Fort Quilenges, 2 ♀, i.ii.1905 (*Ansorge*); SOUTH WEST AFRICA: Okahandja, 1 ♂, 16.ii.1953 (*F. Gaerdes*), in ZSBS, Munich.

DISTRIBUTION. Angola and South West Africa.

REMARKS. *M. quilengesi* is most closely allied to *M. albipuncta*. The anal proximal, oblique-longitudinal dash found in *M. albipuncta* and absent in *M. quilengesi* distinguishes between them.

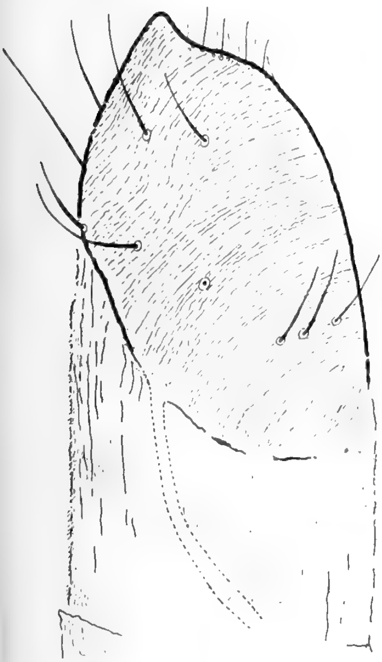
FIG. 85. *M. quilengesi*, ♂, scobinate bar and cornutus.

Masalia terracottoides (Rothschild) **comb. n.**

(Text-figs 86–88; Pl. 5, figs 171–173; Map 9)

Timora terracottoides Rothschild, 1921 : 160. Holotype ♂, NIGER (BMNH) [examined].
Timora fissa Aurivillius, 1925 : 13. Holotype ♂, SUDAN (NR, Stockholm) [examined]. **Syn. n.**

Fore wing with areole present; length ♂ (27), 12·8–16·7 (holotype 14·3), ♀ (20), 14·5–16·7. Wing pattern as in Pl. 5, figs 171–173. Fore wing upper surface with variable colouring; ground colour from pale orange, brownish or greyish orange, light brown to brown; costal margin, upper central, and anal longitudinal streaks, white; postmedial dots, when present, brown, terminal dots white, distally tipped with brown. Hind wing upper surface white, immaculate or suffused with brown.



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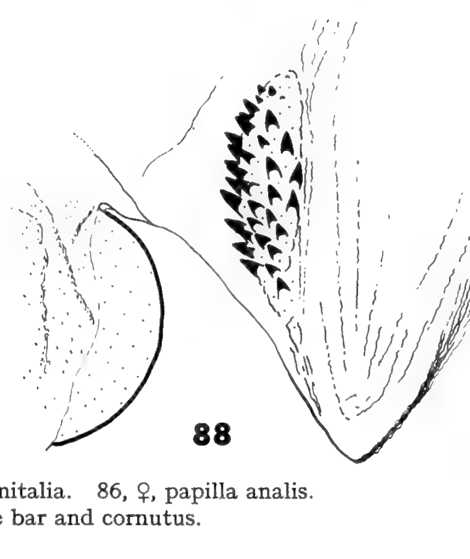


88

FIGS 86–88. *M. terracottoides* genitalia. 86, ♀, papilla analis. 87 and 88, ♂, scobinate bar and cornutus.

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 87, 88. ♀ papilla analis modified, laterally flattened, with a spiculate surface (striate appearance) (Text-fig. 86).

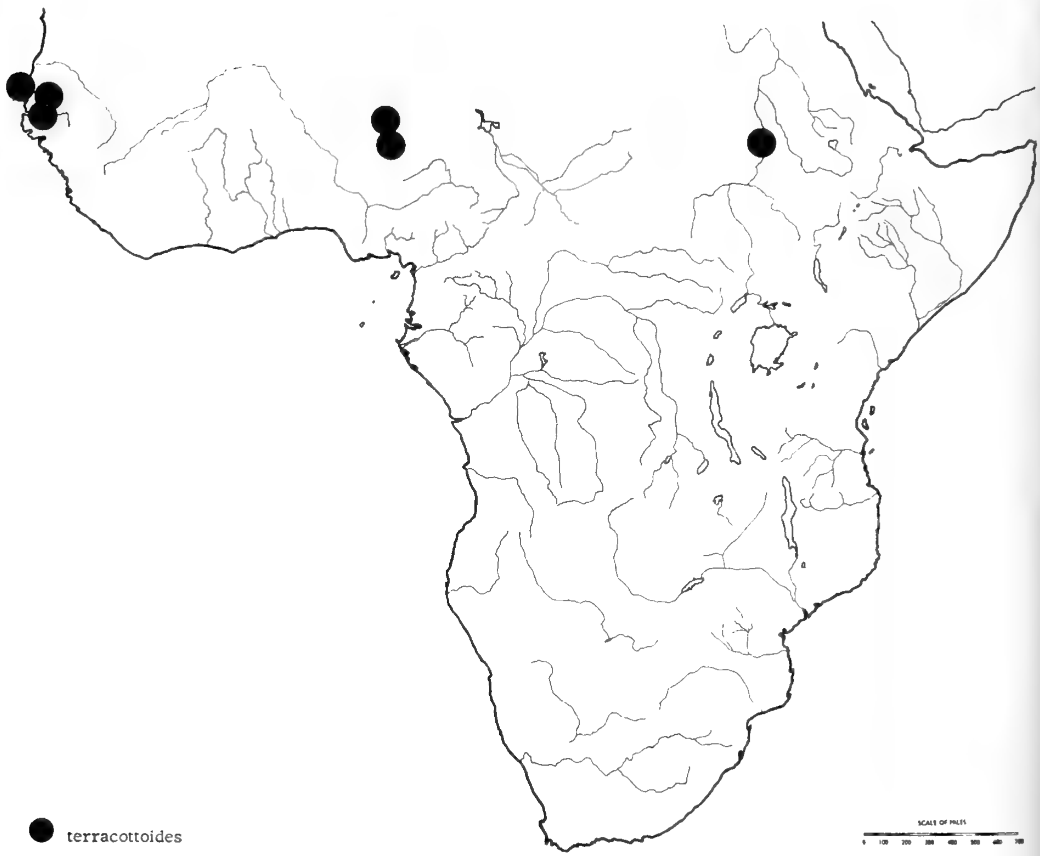
MATERIAL EXAMINED.

Timora terracottoides, holotype, [NIGER:] N. Damagarim, Kaleloua, ♂, 8.ix.1920 (*A. Buchanan*); paratypes, [NIGER:] Damagarim, Baban Tubki, south of Zinder, 2 ♂, 1 ♀, 13.ix.1920; Bande, 2 ♂, 2 ♀, 16.ix.1920; Kaleloua, 5 ♂, 9 ♀, 8.ix.1920; Makochia, 4 ♂, 3 ♀, 15.ix.1920; Songo, 1 ♀, 17.ix.1920 (all coll. *A. Buchanan*). *Timora fissa*, holotype, SUDAN: [Renk,] ♂, (*Pr. W. Exp. Gyld*), in NR, Stockholm.

SENEGAL: Dakar, Aeroport, 1 ♂, 9.ix.1948, in ZSBS, Munich; 1 ♂, 10.ix.1956 (*C. Rungs*), in MNHN, Paris; Kaolack, 2 ♂, 1 ♀, 1909 (*G. Melou*); Senegambia, 2 ♂, x.1907 (*Riggenbach*); GAMBIA: 1 ♂ (*A. Moloney*).

DISTRIBUTION (Map 9). Senegal, Gambia, Niger, Angola and Sudan.

REMARKS. Except for *nubila*, *terracottoides* can be separated from all other species in the genus on the flattened form and spiculate surface of the papilla analis; *nubila* differs from *terracottoides* in the absence of fore wing upper central and anal, longitudinal white streaks.



MAP 9. Distribution of *M. terracottoides*.

Masalia nubila (Hampson) **comb. n.**

(Text-figs 89–90; Pl. 8, figs 203, 204, 205)

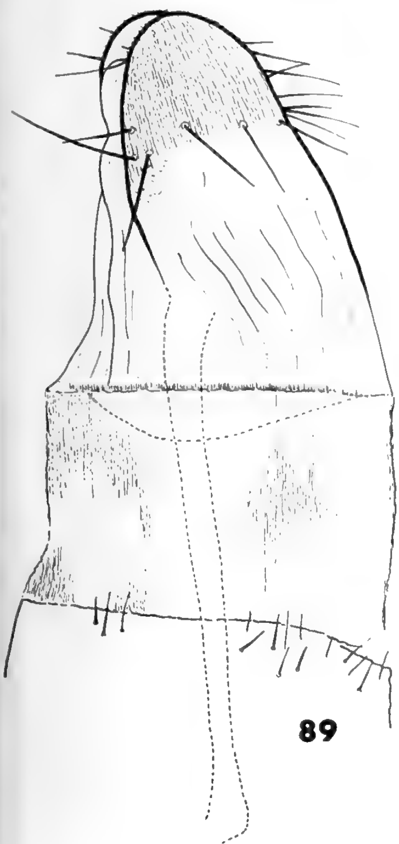
Timora nubila Hampson, 1903 : 108. Holotype ♀, Nigeria (BMNH) [examined].
Timora chrysita de Joannis, 1910 : 225. LECTOTYPE ♀, Guinea (MNHN, Paris), here designated [examined]. **Syn. n.**

Fore wing with areole; length ♂ (4), 12·6–13·0, ♀ (4), 13·4–15·0 (holotype). Wing pattern as in Pl. 8, figs 203–205. Fore wing upper surface with ground colour light yellow to light orange, markings light brown to brown. Hind wing upper surface yellowish white, greyish orange or reddish golden brownish orange.

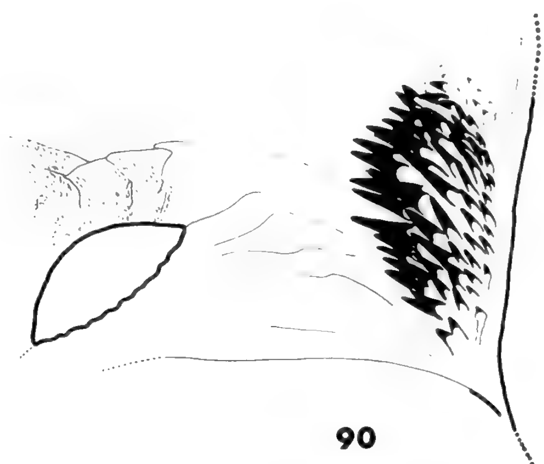
Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 90. ♀ papilla analis simple; surface spiculate (striate appearance) (Text-fig. 89).

Material examined.

Timora nubila, holotype [Nigeria:] River Niger between Akassa and Asaba, ♀



89



90

Figs 89–90. *M. nubila* genitalia. 89, ♀, papilla analis. 90, ♂, scobinate bar and cornutus.

(*F. D. Lugard*). *Timora chrysita*, LECTOTYPE, here designated. [GUINEA] Haute Guinea; Dioudougou, ♀ (*L.& J. de Joannis*), in MNHN, Paris.

SENEGAL: 1 ♂, 6.x.1966, in MNHN, Paris; N'Danoe, 1 ♂, 26.viii.1951 (*B. Boniface*), in MNHN, Paris; GAMBIA: 1 ♀ (*G. Moloney*); GHANA: Northern Territories, Kete-Krachi, 2 ♂, 1 ♀, (*A. W. Cardinall*).

DISTRIBUTION. Senegal, Guinea, Ghana and Nigeria.

REMARKS. This species is closely related to *dora*; the two can be distinguished on differences in the papilla analis, simple in *nubila*, modified in *dora*. It must, however, be noted that this difference is based on a single specimen of *dora* of which the abdomen has been re-attached, apparently correctly matched.

Masalia dora Swinhoe

(Text-figs 91, 92; Pl. 8, figs 206–207)

Masalia dora Swinhoe, 1891 : 147. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].
Timora dora (Swinhoe) Hampson, 1903 : 104.

Fore wing with areole; length ♂ (1), 12·5 (lectotype), ♀ (1), 15·7. Wing pattern as in Pl. 8, figs 206–207. Fore wing upper surface with ground-colour orange to greyish orange, marked with brownish orange. Hind wing upper surface white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 92. ♀ papilla analis modified (Text-fig. 91).

91

92

FIGS 91–92. *M. dora* genitalia. 91, ♀, papilla analis. 92, ♂, scobinate bar and cornutus.

MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA: Maharashtra,] Khandala, ♂, x.1886 (*C. Swinhoe*); paralectotype, [INDIA: Maharashtra,] Khandala, 1 ♀ (*C. Swinhoe*).

DISTRIBUTION. India.

REMARKS. On pattern and colour *dora* appears closely allied to the African ***nubila***. The striking differences between the papilla analis, modified in *dora*, simple in ***nubila***, affords a ready means of identification. Unfortunately this difference is based on a single specimen of *dora* with a re-attached abdomen, though appearing correctly matched. Resemblance in other features is close but on the basis of limited available material, it is thought that the two names should retain their separate specific status.

Masalia semifusca sp. n.

(Pl. 6, fig. 185)

Timora dora (Swinhoe) aberration 1, Hampson, 1903 : 104.
Timora dora ab. *semifusca* Warren, 1913 : 313. Holotype ♀, INDIA (BMNH) [examined].
Timora dora ab. *belgaumensis* Strand, 1916 : 143. Holotype as above. [Objective synonym of *semifusca*].

This species is known only from the female type.

Fore wing with areole; length ♀ (1), 15·7 (holotype). Wing pattern (Pl. 6, fig. 185). Fore wing upper surface colouring between light and greyish orange, almost unicolorous, though anal regions and scaling along the medial and radial veins is of slightly darker tone (greyish orange). Hind wing upper surface yellowish white, proximal area suffused with light brown. The specimen is slightly rubbed and probably faded.

Genitalia. ♀ papilla analis simple.

MATERIAL EXAMINED.

Holotype, [INDIA:] Mysore, Belgaum, ♀, ix.1896 (*Watson*), (Hampson ab. 1; ab. *semifusca* Warren holotype; ab. *belgaumensis* Strand holotype).

DISTRIBUTION. South-west India.

REMARKS. The relationship of *semifusca* to other species within the genus is uncertain and, with the absence of male material, its inclusion in *Masalia* is tentative. It is not thought to be conspecific with *dora*, as was first stated by Hampson (1903), nor is it thought to be closely allied, though some doubt must remain. For, although the papilla anali differ, simple in *semifusca*, modified in *dora*, the comparison is based on only two specimens of which one, the paralectotype of *dora*, possesses a re-attached abdomen. There is also the apparent absence of pattern from these two female specimens, but on what remains of a pattern in *semifusca* there is little to indicate close affinity. Apart from this, *semifusca* differs in fore wing shape and in possessing brown suffusion on the hind wing upper surface.

The name *semifusca* was the first to be given to this unique specimen, and is therefore regarded here as the valid name.

Masalia tosta Moore

(Text-figs 93, 94; Pl. 8, figs 208, 209)

Masalia tosta Moore, 1881 : 411. Lectotype ♀, INDIA (BMNH) [examined].
Timora tosta (Moore) Hampson, 1903 : 115. [Lectotype designated.]

Fore wing with areole; length ♂ (1), 14·7, ♀ (5), 13·6–16·8 (lectotype). Wing pattern as in Pl. 8, figs 208, 209. Fore wing upper surface with ground colour light, greyish, or brownish orange; upper central longitudinal streak, when present, yellowish white; marginal cilia, proximally brownish orange, distally white, the well defined line between the colours giving the outer margin a banded appearance. Hind wing upper surface white, yellowish white or greyish yellow, either immaculate or marginally suffused with light orange.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 94. ♀ papilla analis simple (Text-fig. 93).

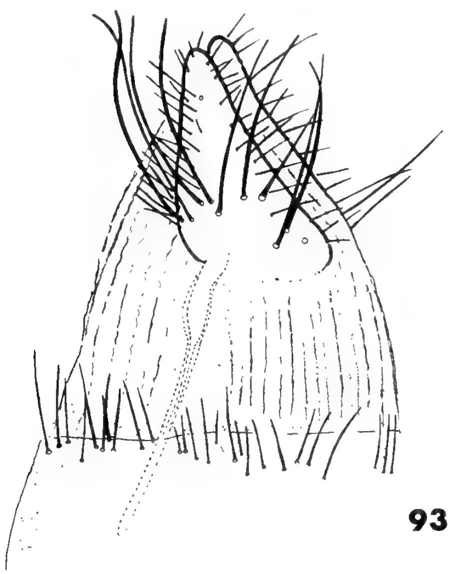
MATERIAL EXAMINED.

Lectotype, [INDIA: Himachal Pradesh,] Dharmsala, ♀ (*Hocking*).

INDIA: Himachal Pradesh, Kangra, Kulu, 1 ♂, 1 ♀ (*G. Young*); H.P., Sultanpur, 3 ♂ (*G. Young*).

DISTRIBUTION. India.

REMARKS. This species can be distinguished by its colouring, particularly the contrasting outer bands of the marginal cilia and, in the female, by the triangular shape of the papilla analis.



93

94

FIGS 93–94. *M. tosta* genitalia. 93, ♀, papilla analis. 94, ♂, scobinate bar and cornutus.

Masalia artaxoides (Moore) **comb. n.**

(Text-fig. 95; Pl. 10, fig. 231)

Pradatta artaxoides Moore, 1881 : 366. LECTOTYPE ♂, INDIA (BMNH), here designated [examined].
Timora artaxoides (Moore) Hampson, 1903 : 116.

Fore wing with areole absent or rarely present; length ♂ (23), 11·9–13·7 (lectotype 13·2), ♀ (11), 12·6–17·0. Wing pattern as in Pl. 10, fig. 231. Fore wing upper surface with ground colour light yellow or occasionally greyish orange; marginal cilia light yellow. Hind wing upper surface light yellow, yellowish grey or brownish grey; marginal cilia light yellow.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 95. ♀ papilla analis simple.

MATERIAL EXAMINED.

LECTOTYPE, here designated, [INDIA:] North West Himalaya, ♂; paralectotypes, [INDIA: Himachal Pradesh,] Dharmsala, 1 ♂ (*Hocking*); [H.P.,], Kula, 1 ♀ (*Hocking*); [Jammu & Kashmir] Kashmir, 1 ♂.

WEST PAKISTAN: Abbottabad, 3 ♂, 1 ♀, viii. (*Mujtaba*); INDIA: Himachal Pradesh, Dalhousie, 1 ♀, v.1891 (*Harford*); H.P., Kangra, Kulu, 2 ♂, 1 ♀ (*A. Young*), 4 ♂

FIG. 95. *M. artaxoides*, ♂, scobinate bar and cornutus.

(*Hocking*), 1 ♀ (*Swinhoe*), 4 ♂, 4 ♀; H.P., Kangra, Sultanpur, 4 ♂ (*G. Young*); north-west India, 2 ♂, 1 ♀; SIKKIM: 1 ♂ (*Elwes*).

DISTRIBUTION. West Pakistan, north India and Sikkim.

REMARKS. The colour and absence of pattern from the upper surface of fore and hind wings distinguishes *artaxoides* from all but four species in the genus, *metaphaea*, *mittoni*, *modesta*, and *semifusca*. *M. metaphaea* is of darker colour and, unlike *artaxoides*, the female has a modified papilla analis. *M. artaxoides* can be separated from *mittoni* and *modesta* on differences in the scobinate bar. The bar in *mittoni* and *modesta* is more convex and packed closely with upward of 40 spicules (Text-figs 97, 98, 99); in *artaxoides* the spicules are sparsely scattered, the number rarely exceeding 20 (Text-fig. 95). *M. artaxoides* differs from *semifusca* in fore wing shape and in hind wing marking.

Masalia metaphaea (Hampson) **comb. n.**

(Text-fig. 96; Pl. 10, fig. 232)

Timora metaphaea Hampson, 1903 : 115. Holotype ♀, INDIA (BMNH) [examined].

The species is known only from female specimens.

Fore wing without areole; length ♀ (8), 13·0–15·1 (holotype 13·4). Wing pattern as in Pl. 10, fig. 232. Fore wing upper surface with brownish orange ground colour; anal region irrorate with brown; marginal cilia brownish orange. Hind wing upper surface brown, marginal cilia brownish orange.

Genitalia. ♀ papilla analis modified, terminal spines absent (Text-fig. 96).

MATERIAL EXAMINED.

Holotype, [INDIA: Himachal Pradesh,] N. W. Himalaya, Mandi, 3–5000 ft, ♀, 1883 (*G. Young*).

WEST PAKISTAN: Baluchistan, 1 ♀; INDIA: Himachal Pradesh, Mandi, 3–5000 ft, 3 ♀, 1883 (*G. Young*); SIKKIM, 3 ♀ (*Elwes*).

DISTRIBUTION. West Pakistan, north-east and north-west India, Sikkim.

REMARKS. Upper surface fore and hind wing colouring and virtual absence of pattern (fore wing anal region irrorate with brown) distinguishes *metaphaea* from all other species in the genus.

Masalia mittoni (Pinhey) **comb. n.**

(Text-figs 97, 98; Pl. 10, fig. 233)

Timora mittoni Pinhey, 1956 : 13. LECTOTYPE ♂, TANZANIA (BMNH), here designated [examined].

Fore wing with areole; length ♂ (18), 12·1–13·9 (lectotype 13·5), ♀ (14), 13·7–15·5. Wing pattern as in Pl. 10, fig. 233. Fore wing upper surface with ground colour from pale to light orange, light to moderately irrorate with brown; extent of irrorate area variable. Hind wing upper surface light brown to brown.

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 97, 98. ♀ papilla analis simple.

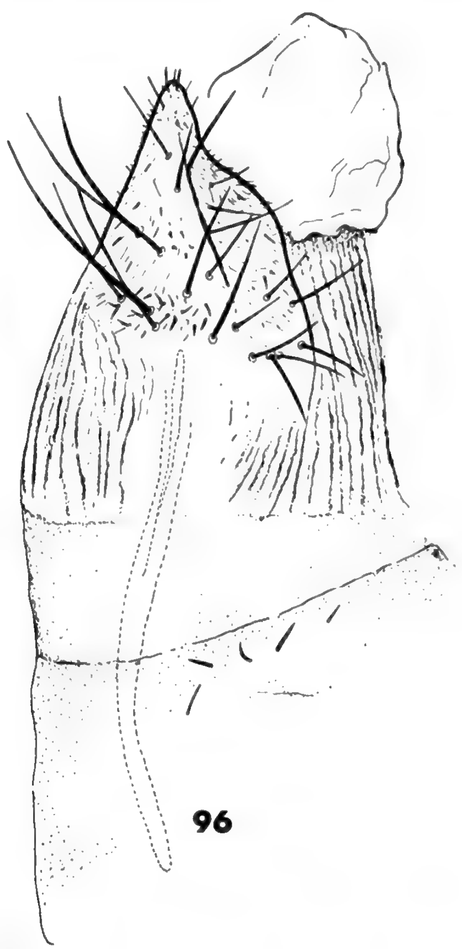
MATERIAL EXAMINED.

LECTOTYPE, here designated, [TANZANIA] Tanganyika: Iringa, ♂, iii.1950 (*N. Mitton*); paralectotypes, [TANZANIA] Tanganyika: Iringa, 11 ♂, 14 ♀, iii.1950 (*N. Mitton*).

TANZANIA: Iringa, 6 ♂, iii.1950 (*N. Mitton*).

DISTRIBUTION. Tanzania.

REMARKS. The fore and hind wing colouring of the upper surface, and absence of a definite pattern, distinguish *mittoni* from all but two other species in the genus, *metaphaea* and *artaxoides*. *M. metaphaea* is of darker colouring and, unlike *mittoni*, the female has a modified papilla analis. *M. artaxoides* and *mittoni* can be separated on differences in the scobinate bar. The bar in *mittoni* is more convex and closely packed with upward of 40 spicules (Text-figs 97, 98); in *artaxoides* the spicules are sparsely scattered and rarely exceed 20 in number (Text-fig. 95).



96

FIG. 96. *M. metaphaea*, ♀, papilla analis.

Masalia modesta (Moore) **comb. n.**

(Text-fig. 99; Pl. 10, fig. 234)

Pradatta modesta Moore, 1881 : 366. LECTOTYPE ♀ India (BMNH) here designated [examined].
Timora modesta (Moore) Hampson, 1903 : 116.
Curubasa calamaria Moore, 1881 : 367. LECTOTYPE ♂, India (BMNH), here designated [examined]. [Synonymized by Hampson 1903 : 116.]

Fore wing with areole; length ♂ (3), 12·0–12·3, ♀ (1), 11·0 (lectotype). Wing pattern as in Pl. 10, fig. 234. Fore wing upper surface pale yellow. Hind wing upper surface pale yellow. Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 99. ♀ papilla analis simple.

Material examined.

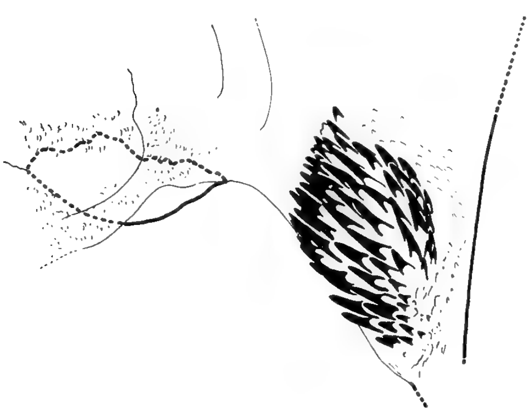
Pradatta modesta, LECTOTYPE, here designated, India: [Uttar Pradesh, Mainpuri] Manpuri, ♀; *Curubasa calamaria*, LECTOTYPE, here designated, [India: Maharashtra,] Bombay, ♂.

India: Madhya Pradesh, Jubbulpore, 2 ♂.

Distribution. India.

Remarks. The four specimens in the collection of the British Museum (Natural History) appear faded. In one specimen the fore wing upper surface has traces of pale red on the costal and anal regions.

The colour and virtual absence of pattern from the upper surface of the fore and hind wings separate *modesta* from all but one other species in the genus, *artaxoides*. *M. modesta* and *artaxoides* can be separated on differences in the scobinate bar. The bar in *modesta* is more convex and closely packed with upward of 40 spicules (Text-fig. 99); in *artaxoides* the spicules are sparsely scattered and rarely exceed 20 in number (Text-fig. 95).



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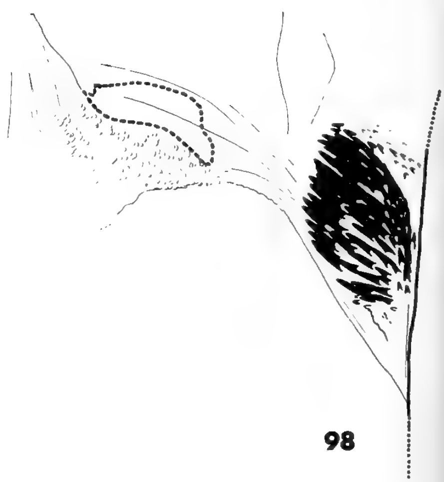


98

Figs 97–98. *M. mittoni*, ♂, scobinate bar and cornutus.

Masalia bimaculata (Moore) **comb. n.**

(Text-figs 100–109; Pl. 9, figs 210–221; Map 10)

Pradatta bimaculata Moore, 1888 : 411.

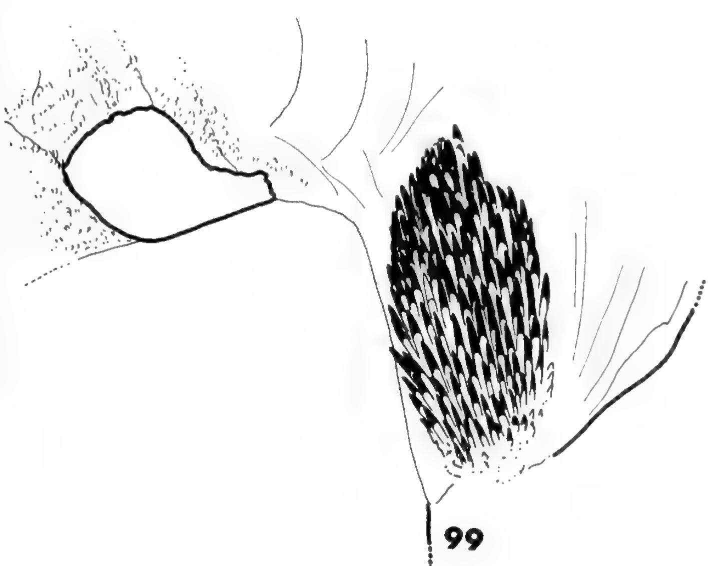
M. bimaculata is a variable species, in size, extent of pattern differentiation and colour. A combination of two characters, (1) the presence of a brown discocellular spot, occasionally faint but rarely indistinguishable against the surrounding colour, and (2) the modified form of the papilla analis devoid of terminal spines, separates *M. bimaculata* from other species in *Masalia*.

Four subspecies are recognized, the structural differences being as follows:

	Areole	Cornutus	Distribution
M. b. bimaculata	present	present	Indian
M. b. cornia	absent	present	African
M. b. nigrifasciata	present or absent	present	African
M. b. pluritelifora	absent	absent	African

Though variation in colour and marking occurs between the four, pattern differences are not marked and are further obscured by variation within, and slight overlap between, them. *M. b. nigrifasciata*, linking with *M. b. bimaculata* and *M. b. cornia* on presence and absence, respectively, of an areole is, on colour and marking, the most readily distinguished. These differences are set out below.

M. b. nigrifasciata. Costal and anal regions typically dull red, central region yellowish white to light yellow; dark brown lower central longitudinal streak well developed.

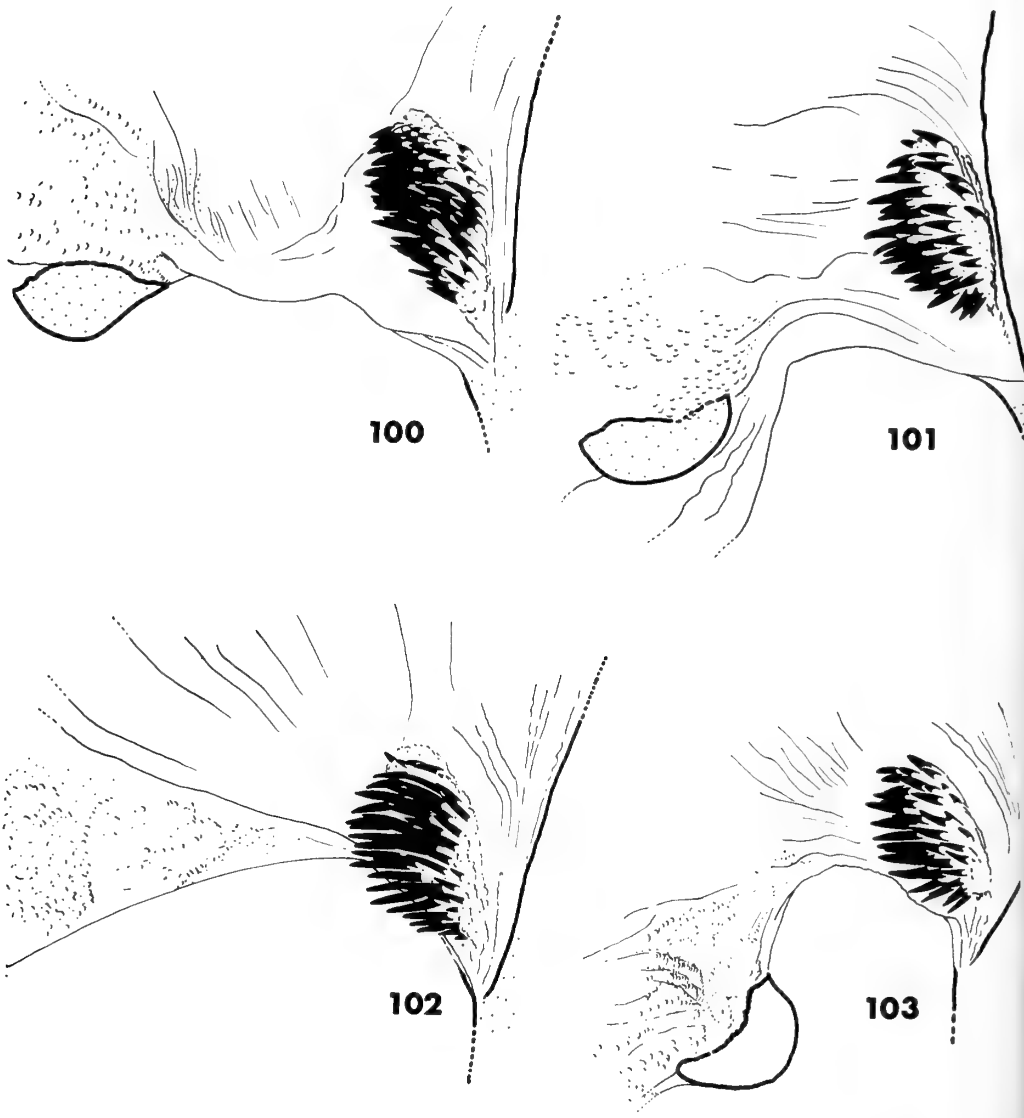


99

FIG. 99. *M. modesta*, ♂, scobinate bar and cornutus.

M. b. bimaculata. Costal, central and anal regions white to pale yellow; brown lower central longitudinal streak absent or present.

M. b. cornia. Costal, central and anal region from pale yellow to reddish grey; dark brown lower central longitudinal streak present or absent. Or, costal and anal regions reddish white, with a poorly developed brown lower central longitudinal streak.



FIGS 100–103. *M. bimaculata* subspecies, scobinate bar and cornutus of male genitalia. 100, *bimaculata bimaculata*. 101, *bimaculata nigrifasciata*. 102, *bimaculata pluritelifora*. 103, *bimaculata cornia*.

M. b. pluritelifora. Costal, central and anal regions greyish orange to reddish grey irrorate with brown; a white upper central longitudinal streak usually present; brown lower central longitudinal streak poorly developed or absent.

Masalia bimaculata bimaculata (Moore)

(Text-figs 100, 104; Pl. 9, figs 210, 211; Map 10)

Pradatta bimaculata Moore, 1888 : 411. Holotype ♂, INDIA (BMNH) [examined].
Timora bimaculata (Moore) Hampson, 1903 : 109.
Pradatta pallescens Hampson, 1891 : 70. LECTOTYPE ♂, INDIA (BMNH), here designated [examined]. [Synonymized by Hampson, 1903 : 109.]
Pradatta pulverulenta Hampson, 1891 : 71. Holotype ♂, INDIA (BMNH) [examined]. [Synonymized by Hampson (stated to be an aberration), 1903 : 109.]

Fore wing with areole; length ♂ (11), 10·4 (holotype)–14·6, ♀ (5), 13·2–15·5. Wing pattern as in Pl. 9, figs 210, 211. Fore wing upper surface with ground colour yellowish white to pale yellow, immaculate or finely irrorate with brown. Lower central longitudinal streak (when present) and discocellular spot, brown. Hind wing upper surface white to yellowish white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 100. ♀ papilla analis modified, terminal spines absent, dorso-lateral surface sericate (Text-fig. 104).

MATERIAL EXAMINED.

Pradatta bimaculata, holotype, [INDIA: Himachal Pradesh,] Dharmsala, ♂ (*J.H.Hocking*). *Pradatta pallescens*, LECTOTYPE, here designated, [INDIA: Madras,] Nilgiris, ♂, (*Hampson*); paralectotypes, [INDIA: Madras,] Nilgiris, 3 ♂ (*Hampson*). *Pradatta pulverulenta*, holotype, [INDIA: Madras,] Nilgiris, ♂ (*Hampson*).

INDIA: Himachal Pradesh, Kangra Valley, 4500 ft, 1 ♂, ix.1899 (*Dudgeon*); H.P., Sultanpur, Kulu, 1 ♂; H.P., Sultanpur, Kulu, 1 ♀, 1889 (*G. Young*); Kerala, Peermade, 1 ♀ (*Imray*); K., Travancore Place, 1 ♂, 1 ♀; Madras, Nilgiris, 1 ♂, 1 ♀; M., Nilgiris, 1 ♂ (*Hampson*); Madhya Pradesh, Mhow, 1 ♀.

DISTRIBUTION (Map 10). India.

REMARKS. The nominate subspecies and *M. b. nigrifasciata* are distinguishable on differences in colouring of the costal and anal regions, and the presence of the areole in *M. b. bimaculata* distinguishes it from *M. b. cornia* and *M. b. pluritelifora*, in which areoles are absent.

Masalia bimaculata nigrifasciata (Hampson) **comb. et stat. n.**

(Text-figs 101, 108, 109; Pl. 9, figs 216–219; Map 10)

Timora nigrifasciata Hampson, 1903 : 110. LECTOTYPE ♂, KENYA (BMNH), here designated [examined].
Timora bimaculata var. *unifasciata* Gaede, 1915 : 39. Holotype ♂, TANZANIA (MNHU, Berlin) [examined]. [Synonymized with *Timora pulverulenta* Hampson by Gaede, 1935 : 106.] **Syn. n.**

Fore wing with or without areole; length ♂ (83), 13·0–16·5 (lectotype 15·8), ♀ (42), 14·9–18·1. Wing pattern as in Pl. 9, figs 216–219. Fore wing upper surface with costal and anal regions pale to dull red; central region yellowish white to light yellow occasionally with pale to dull red extending in from the costal and anal regions. In a number of specimens the regions are finely irrorate with dark brown; lower central longitudinal streak and discocellular spot also dark brown. Hind wing upper surface yellowish white to pale yellow.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 101. ♀ papilla analis modified, terminal spines absent, dorso-lateral surface sericate (Text-figs 108, 109).

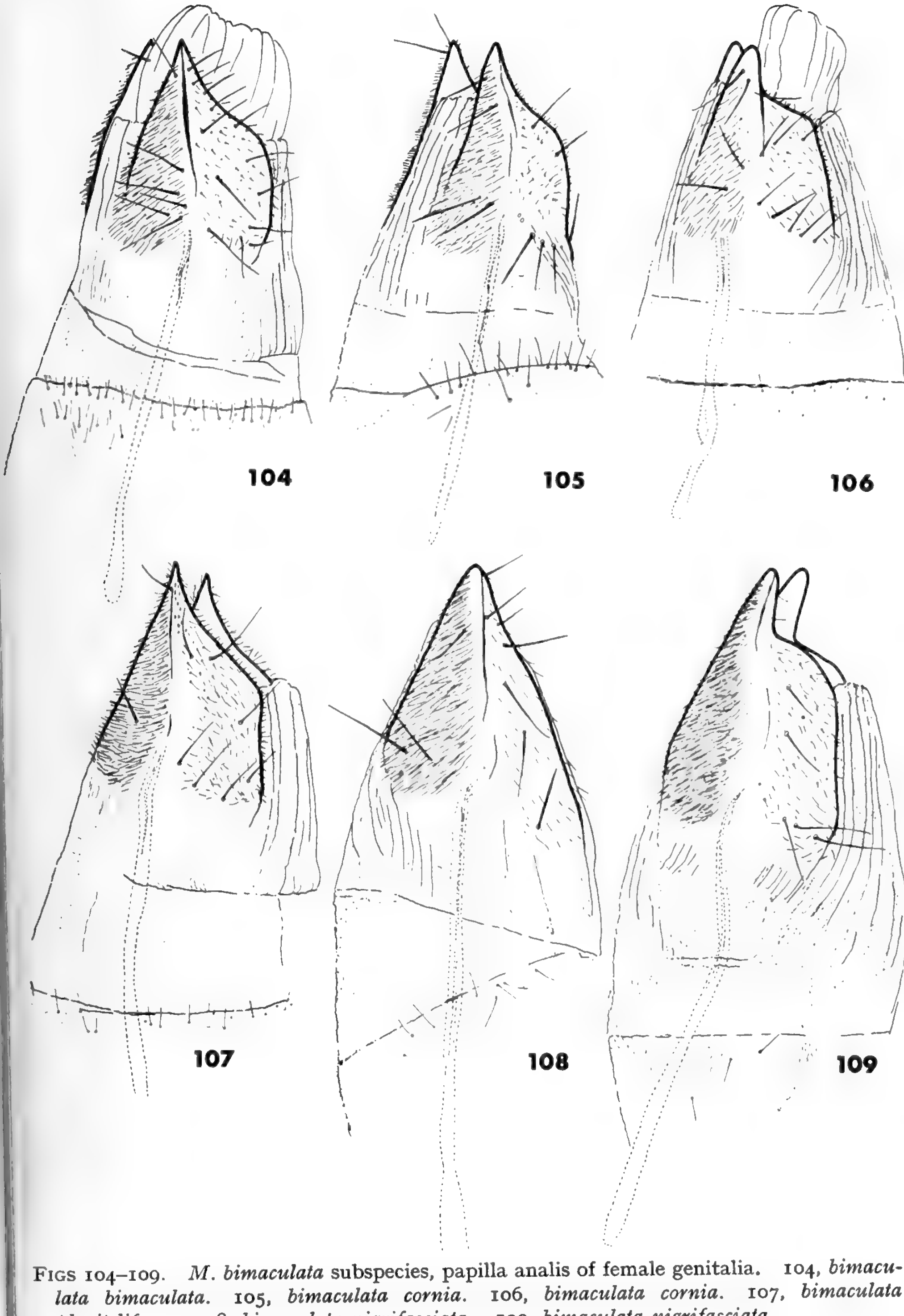
MATERIAL EXAMINED.

Timora nigrifasciata, LECTOTYPE, here designated, [KENYA] B.E. Africa: Eb Urru, ♂, 16.iv.1900 (*C. S. Betton*); paralectotypes, [KENYA] B.E. Africa: Eb Urru, 1 ♂, 21.iii.1900; 1 ♀, 22.iii.1900; 1 ♀, 23.iii.1900; 1 ♀, 1.iv.1900; 1 ♂, 20.iv.1900, 1 ♀, 30.v.1900 (all *C. S. Betton*). *Timora bimaculata* var. *unifasciata*, holotype, [TANZANIA:] Mkalama, ♂, 4.iv.1905 (*Marwitz*), in MNHU, Berlin; paratype, [TANZANIA:] Mkalama, ♀, 9.ii.1905 (*Marwitz*), in MNHU, Berlin.

UGANDA: W. Ankole, 4500–5000 ft, 1 ♀, 11.x.1911 (*S. A. Neave*); Mbarara, 1 ♂ (*R. E. McConnell*); S.E. Ruwenzori, 3500 ft, 1 ♂, 16.iv.1906 (*G. Legge & A. F. R. Wollaston*); KENYA: Eb Urru, 2 ♂, 22.iii.1900; 1 ♀, 23.iii.1900; 1 ♂, 25.iii.1900; 1 ♂, 26.iii.1900; 1 ♀, 31.iii.1900; 1 ♂, 19.iv.1900 (all *C. S. Betton*); Mt. Elgon, 1 ♀, v.1932 (*T. H. E. Jackson*); Hoey's Bridge, 2 ♂ (*Pitman*); Kavirondo, Suna, 1 ♂, 1 ♀, xi.1930; 1 ♀, i.1931; 1 ♂, iii.1931; 1 ♂, 2 ♀, iv.1931; 4 ♂, xi.1931; 10 ♂, xii.1931; 7 ♂, 2 ♀, i.1932; 1 ♂, ii.1932; 3 ♂, 2 ♀, iii.1932; 9 ♂, 4 ♀, iv.1932; 2 ♂, 2 ♀, v.1932 (all *W. Feather*); 2 ♂, 7 ♀, iv.1932 (*van Someren*); Kitale, 1 ♂, 24.iv.1927; 1 ♂, 17.iv.1931; 1 ♂, (all *G. W. Jeffery*); Lumbwa, 1 ♂, 10.iv.1923 (*G. W. Jeffery*); Nairobi, 1 ♂, 1.vi.1905 (*F. J. Jackson*); 2 ♀, 21.iv.1916 (*W. A. Lamborn*); 5600 ft, 3 ♂, 1 ♀ (*W. N. van Someren*); 1 ♀, iv.1927 (*D. M. Hopkins*); Nakutu, 1 ♂, 1 ♀, 8.v.1911; 1 ♂ (*H. A. Bodeker*); 2 ♂, iv.1940; 2 ♂, iv.1941; 1 ♂, 6.vi.1943; 1 ♂, 17.viii.1944 (all *A. Townsend*); Nandi, Moboroni, 1 ♀, vii.1903 (*F. J. Jackson*); TANZANIA: Arusha District, 1 ♀ (*M. S. Moore*); Arusha District, Ngorongoro Crater, 5900 ft, 1 ♂, 2 ♀, iii.1921 (*T. A. Barns*); District of Great Craters, 1 ♂, ii–iii.1921 (*T. A. Barns*); Kigoma, 1 ♂, iv.1961 (*Goodall*); W. Kilimanjaro, 4000–5000 ft, 1 ♂, 1 ♀, ii.iii.1937; 1 ♂, iv.–v.1937 (*B. Cooper*); Musoma, Banagi Hill, 1 ♂ (*M. S. Moore*); Nachingwe, 2 ♂, iv.1961 (*W. Bigger*); ETHIOPIA: 1 ♂. Specimens with incomplete data 4 ♂, 2 ♀.

DISTRIBUTION (Map 10). Uganda, Kenya, Tanzania and Ethiopia.

REMARKS. *M. b. nigrifasciata* is distinguishable from the nominate subspecies and from *M. b. pluritelifora* on the colour difference of the costal and anal regions. Difference in colour and marking also serves to distinguish most specimens of *M. b. cornia* from *M. b. nigrifasciata*. The range of variation in these two subspecies however, is such that a continuous series can be traced from one to the other. In *M. b. nigrifasciata* there is a shift of tone from dull red toward greyish orange, accompanied by dilution of dark brown from the lower central longitudinal streak (Pl. 9, figs 216, 217). The known intergrade variants were taken from localities on the common borders between the two subspecies.



Figs 104–109. *M. bimaculata* subspecies, papilla analis of female genitalia. 104, *bimaculata bimaculata*. 105, *bimaculata cornia*. 106, *bimaculata cornia*. 107, *bimaculata pluritelifora*. 108, *bimaculata nigrifasciata*. 109, *bimaculata nigrifasciata*.

Masalia bimaculata cornia subsp. n.

(Text-figs 103, 105, 106; Pl. 9, figs 212–215; Map 10)

Fore wing without areole; length ♂ (10), 10·5–14·5 (holotype), ♀ (2), 12·3–15·4. Wing pattern variable (Pl. 9, figs 212–215). Fore wing upper surface with costal, central and anal regions yellowish white to pale or greyish orange, finely, moderately or densely irrorate with brown. Central region uniform or of different colour to costal and anal regions. Discocellular spot, and lower central longitudinal streak when present, brown. A white upper central longitudinal streak may also be present. Hind wing upper surface yellowish white.

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 103. ♀ papilla analis modified, terminal spines absent, dorso-lateral surface seriate (Text-figs 105, 106).

MATERIAL EXAMINED.

Holotype, [CONGO (KINSHASA):] Luvua River (east Bank), 85 miles North of Lake Mweru, 3000 ft, ♂, iv.1922 (end of wet season) (*T. A. Barns*).

Paratypes. [ANGOLA:] Capelongo, 1 ♂, 20.xii.1912 (Mission Rohan–Chabot), in MNHN, Paris; [CONGO (KINSHASA):] Luvua River, 85 miles north of Lake Mweru, 3000 ft, 1 ♂, 1 ♀, ix.1922 (*T. A. Barns*); [SUDAN:] Darfur Province, Kulme, 1 ♂, 1921 (*H. Lynes*); Gondokoro, White Nile, 5 ♂, 1 ♀ (*W. E. Reymes-Cole*); Southern Bahr-el-Ghazal, Tambura, 1 ♂.

DISTRIBUTION (Map 10). Congo (Kinshasa) and Sudan.

REMARKS. The presence of a cornutus in this subspecies readily distinguishes it from *M. b. pluritelifora*, whilst the absence of an areole distinguishes it from *M. b. bimaculata*. *M. b. cornia* and *M. b. nigrifasciata* differ in fore wing colour and pattern, but both are variable and intergrade variants do occur.

The name *cornia* was a manuscript name of Miss A. E. Prout and the type selected by her is designated here as holotype.

Masalia bimaculata pluritelifora (Berio) comb. et stat. n.

(Text-figs 102, 107; Pl. 9, figs 220, 221; Map 10)

Timora pluritelifora Berio, 1966 : 110. Holotype ♀, SENEGAL (MNHN, Paris) [examined].
Timora rosastrigata Berio, 1966 : 111. Holotype ♀, SENEGAL (MNHN, Paris) [examined]. **Syn. n.**

Fore wing without areole; length ♂ (8), 11·0–11·8, ♀ (8), 12·2–14·1 (holotype 13·2). Wing pattern as in Pl. 9, fig. 220, 221. Fore wing upper surface with ground colour greyish orange, greyish red, pale red or reddish grey, fine to densely (as in type) irrorate with brown. When present, upper central longitudinal streak white; discocellular spot brown, faint (occasionally indistinguishable against the irrorate ground) to well developed. Hind wing upper surface yellowish white.

Genitalia. ♂ cornutus absent; scobinate bar and proximal end of vesica as in Text-fig. 102. ♀ papilla analis modified, terminal spines absent, dorso-lateral surface sericate (Text-fig. 107).

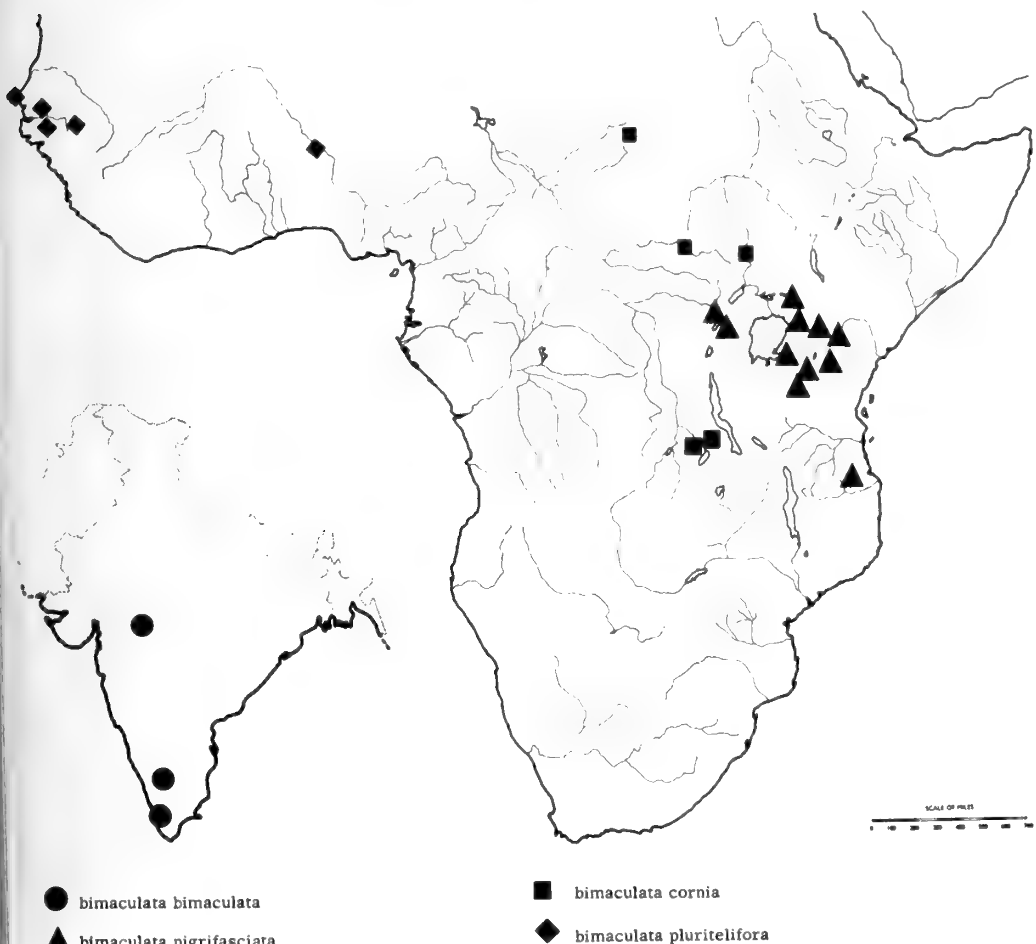
MATERIAL EXAMINED.

Timora pluritelifora, holotype, SENEGAL: Badi, Parc National Niokola Koba, ♀, 15.vii.–25.ix.1955 (Instit. franc. d'Afrique noire, Dakar), in MNHN, Paris. *Timora rosastrigata*, holotype, SENEGAL: Badi, Parc National Niokola Koba, ♀, 3.ix.1958 (Inst. franc. d'Afrique noire, Dakar), in MNHN, Paris.

SENEGAL: Dakar, 3 ♂, 1 ♀, 10–12.ix.1956 (*C. Rungs*), in MNHN, Paris; Kaolack, 1 ♀, 1909 (*G. Melou*); Sedhiou, 1 ♂, 1 ♀, 1917 (*H. Castell*); GHANA: Northern Territories, Kete-Krachi, 2 ♂, 4 ♀ (*A. W. Cardinall*); NIGERIA: Ogruga [? Ogrugru], River Niger, 2 ♂, 1 ♀.

DISTRIBUTION (Map 10). Senegal, Ghana, Nigeria.

REMARKS. The absence of a cornutus in the male of *M. b. pluritelifora* distinguishes it from the three other subspecies.



MAP 10. Distribution of subspecies of *M. bimaculata*.

Masalia flavocarnea (Hampson) **comb. n.**

(Text-fig. 110; Pl. 9, fig. 222)

Timora flavocarnea Hampson, 1903 : 115. Holotype ♀, ETHIOPIA (BMNH) [examined].

Fore wing without areole; length ♀ (1), 16·8 (holotype). Wing pattern as in Pl. 9, fig. 222. Fore wing upper surface with ground colour pale to greyish orange, discocellular spot brown. Hind wing upper surface pale yellow irrorate with light brown.

Genitalia. ♀ papilla analis modified; dorso-lateral surface sericate and with terminal spines (Text-fig. 110).

MATERIAL EXAMINED.

Holotype, [ETHIOPIA] Abyssinia, ♀.

DISTRIBUTION. Ethiopia.

REMARKS. Within the genus, *M. flavocarnea* can be separated from all but *M. bimaculata* on fore wing colour and marking. *M. flavocarnea* and *M. bimaculata* are separable on the presence and absence respectively of papilla anali terminal spines.

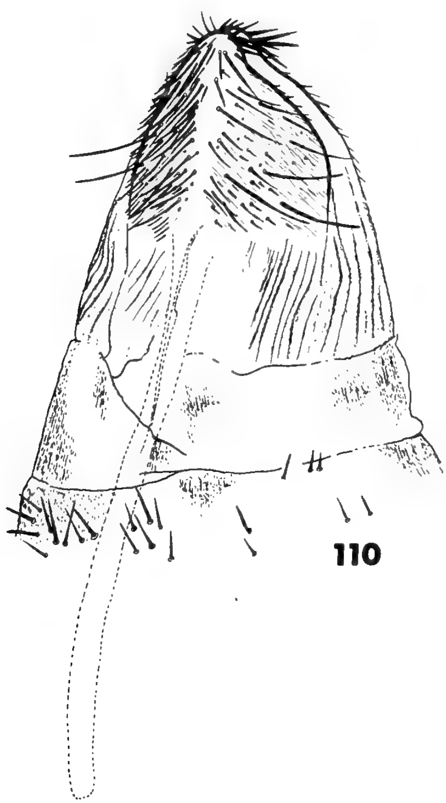


FIG. 110. *M. flavocarnea*, ♀, papilla analis.

Masalia albida (Hampson) **comb. n.**

(Text-figs 20, 111; Pl. 10, figs 223–225)

Timora albida Hampson, 1905 : 450. LECTOTYPE ♂, ALGERIA (BMNH), here designated [examined]. [Synonymized with *Argyrospila striata* Staudinger, 1897 : 265, by Warren, 1911 : 248; recalled from synonymy by Draudt, 1935 : 197.]

Lecerfia chitinipyga Dumont, 1920 : 102. LECTOTYPE ♂, ALGERIA (MNHN, Paris), here designated [examined]. [Synonymized by Draudt, 1935 : 197.]

Antenna with flagellar segments sexually dimorphic. Proboscis quotient: 6. Fore wing with areole; length ♂ (51), 13·2–15·8 (lectotype 14·3), ♀ (40), 13·9–16·4. Wing pattern as in Pl. 10, figs 223–225. Fore wing upper surface with ground colour greyish yellow to greyish orange. Upper central and anal longitudinal streaks, and costal and anal margins, white. In addition a variable number of white streaks may be present; veins between which streaks occur are: R_4–R_5, R_5–M_1, M_2–M_3, M_3–Cu_{1a} and Cu_{1a}–Cu_{1b}. Hind wing upper surface white to yellowish white, either immaculate or central veins greyish orange. Eighth abdominal tergum with posterior margin centrally incurved; incurved region ridged (Text-fig. 20).

Genitalia. ♂ scobinate bar and cornutus as in Text-fig. 111. ♀ papilla analis simple.

MATERIAL EXAMINED.

Timora albida, LECTOTYPE, here designated, ALGERIA: Hammam-es-Salahin, ♂, 9.iv.1904; paralectotype, ALGERIA: Hammam-es-Salahin, ♀, 16.iv.1904. *Lecerfia chitinipyga*, LECTOTYPE, here designated, [ALGERIA] Algine: El Golea, ♂, in MNHN, Paris.

ALGERIA: east of Guerrara, 1 ♂, 13.iv.1914; El Alia, between Touggourt and Guerrara, 1 ♂, 4 ♀, 12.iv.1914; Hassi Dinar, south of Touggourt, 1 ♀, 11.iv.1914; Hassi Sidi Mahmud, between El Arich and Oued Nga, 1 ♂, 4.iv.1914; Mzab Country, Oued Nga, 1 ♀, 16–30.iv.1914; South Oran, Ain Sefra, 31 ♂, 15 ♀; 3–9.v.191 3;2 ♂,

FIG. 111. *M. albida*, ♂, scobinate bar and cornutus.

1 ♀, 13.v.1915 (*V. Faroult*); Touggourt, 1 ♂, 12.iv.1914; SAUDI ARABIA: El Riad, 3 ♂, 5 ♀, xi.1958 (*E. Diehl*), in ZSBS, Munich; El Ryadh, 3 ♂, 6 ♀, 18.iii.1958 (*E. Diehl*), in ZSBS, Munich; Jidda, 1 ♂, 13.iii.1929 (*H. St J. B. Philby*); Tihama of Asir, 1 ♀, 27.iii.1948; IRAN: Belutschistan, Jranshar, 800 m, 3 ♂, 3 ♀, 1–10.iii.1954 (*Richter & Schäuffele*); 1 ♀, 28–31.iii.1954 (*Richter & Schäuffele*), in ZSBS, Munich.

DISTRIBUTION. Algeria, Arabia and Iran.

REMARKS. The long tongue together with the ridged incurved region of the 8th abdominal tergum readily distinguishes *albida* from other species in this genus.

Masalia perstriata (Hampson) comb. n.

(Text-figs 10, 112, 113; Pl. 10, figs 226–230; Map 11)

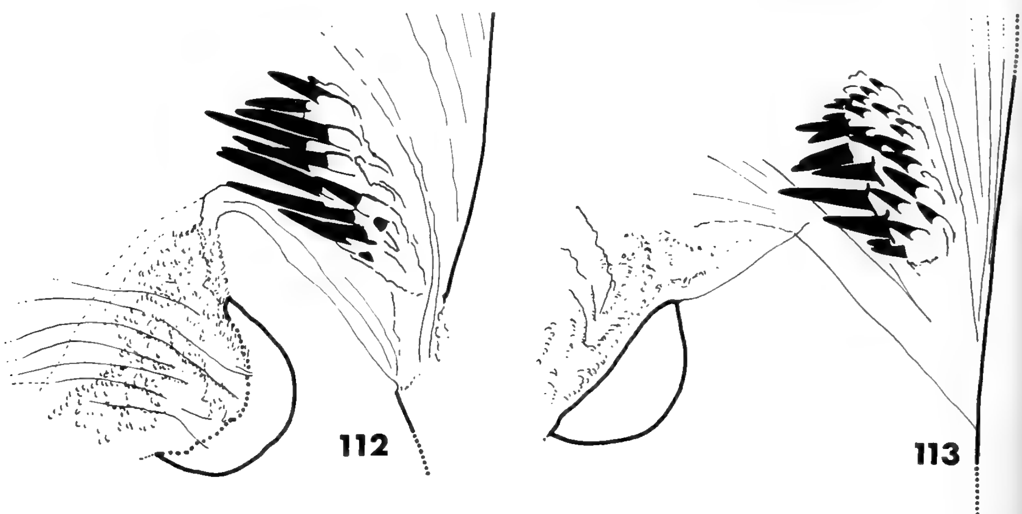
Raghuva perstriata Hampson, 1903 : 32.

Antenna with flagellar segments sexually dimorphic. Proboscis quotient: 5. Fore wing with areole. In the male, the costa dilates at a point a little beyond the centre to form a node. Into this node runs an elongate ridge, which arises from a position anterior to the areole, between R_1–R_4 (Text-fig. 10). The node and ridge are not differentiated in the female.

Genitalia. ♂ scobinate bar and cornutus as in Text-figs 112, 113. ♀ papilla analis simple.

REMARKS. The long proboscis together with male characters, the node and ridge in the fore wing and the few but well developed scobinate bar spicules, distinguish *M. perstriata* from other species in the genus.

Three subspecies are recognized, the nominate subspecies from India, *M. p. fuscostriata* from Arabia and Iran, and *M. p. zernytamsia* from east Africa. The nominate subspecies and *M. p. zernytamsia* are marked on the fore wing with a row of terminal dots, which are absent in *M. p. fuscostriata*. No morphological differences have been found between *M. p. perstriata* and *M. p. zernytamsia*.



FIGS 112–113. *M. perstriata* subspecies, scobinate bar and cornutus of male genitalia. 112, *perstriata perstriata*. 113, *perstriata fuscostriata*.

Masalia perstriata perstriata (Hampson)

(Text-fig. 112; Pl. 10, fig. 229, Map 11)

Raghuva perstriata Hampson, 1903 : 32. Holotype ♂, INDIA (BMNH) [examined].

This subspecies is known only from male specimens.

Fore wing length, ♂ (2), 13·8–14·0 (holotype). Wing pattern as in Pl. 10, fig. 229. Fore wing upper surface with ground colour yellowish white to pale yellow; postmedial and terminal dots and the rather faintly marked lower central, longitudinal streak, brown. Hind wing upper surface white to yellowish white.

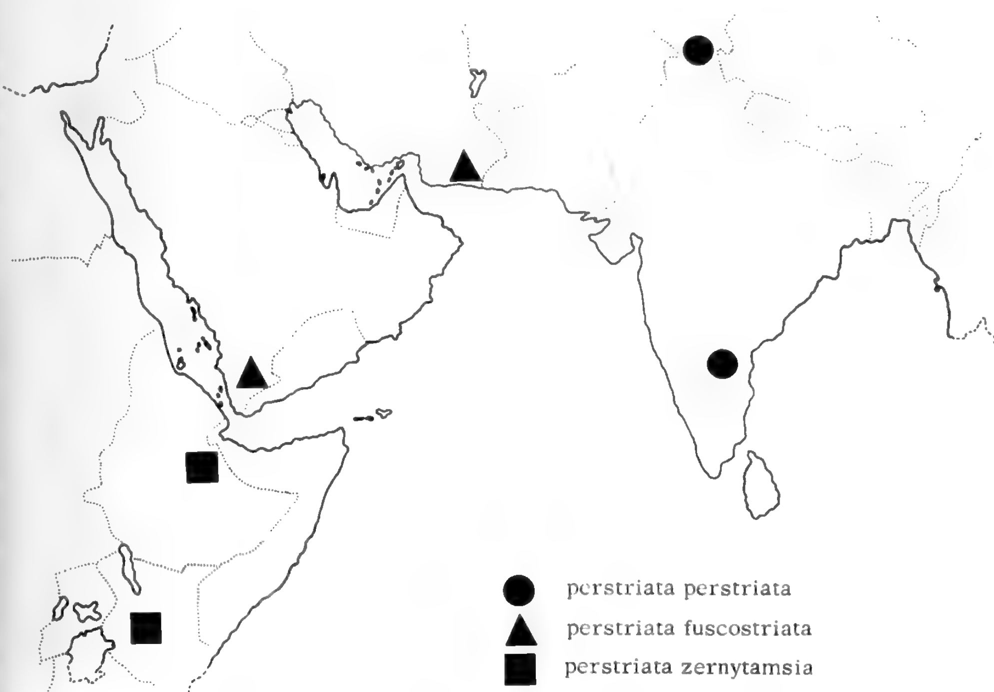
MATERIAL EXAMINED.

Holotype, INDIA: [Himachal Pradesh.], N. W. Himalayas, Fort Kangra, ♂, 17.vii.1884 (*Moore*).

INDIA (southern): Gooty, 1 ♂ (*W. H. Campbell*).

DISTRIBUTION (Map 11). India.

REMARKS. The presence in *M. p. perstriata* of brown terminal dots distinguishes it from *M. p. fuscostriata*, in which these dots are absent. Morphological differences have not been found between *M. p. perstriata* and *M. p. zernytamsia*. These two subspecies are geographically separated by *M. p. fuscostriata* (Map 11).



MAP 11. Distribution of subspecies of *M. perstriata*.

Masalia perstriata fuscostriata (Brandt) **comb. et stat. n.**

(Text-fig. 113; Pl. 10, figs 226–228; Map 11)

Timora fuscostriata Brandt, 1914 : 854. LECTOTYPE ♂, IRAN (NR, Stockholm), here designated [examined].

Fore wing, length ♂ (3), 14·3–15·4 (lectotype), ♀ (3), 15·2–17·0. Wing pattern as in Pl. 10, figs 226–228. Fore wing upper surface with ground colour white to yellowish white; costal and anal regions fine to moderately irrorate with brown; lower central longitudinal streak either straight or distad-splayed and postmedial dots, when present, brown. Hind wing upper surface white to yellowish white.

MATERIAL EXAMINED.

LECTOTYPE, here designated, IRAN: Baloutchistan, Bender Tchahbar, ♂, 27.ii.–3.iii.1938 (*Brandt*), in NR, Stockholm; paralectotypes, IRAN: Baloutchistan, Bender Tchahbar, 1 ♂, 1 ♀, 27.ii.–3.iii.1938 (*Brandt*), in NR, Stockholm; 1 ♂, 1 ♀, 16 and 20.ii.1938 (*Brandt*), in ZSBS, Munich.

SAUDI ARABIA: Rada, 1 ♀, 4.ix.1962 (*G. Popov*).

DISTRIBUTION (Map 11). Saudi Arabia and Iran.

REMARKS. The absence of fore wing terminal dots in *M. p. fuscostriata* distinguishes it from the two other subspecies, *M. p. perstriata* and *M. p. zernytamsia*, in which brown terminal dots are present.

Masalia perstriata zernytamsia (Berio) **comb. et stat. n.**

(Pl. 10, fig. 230; Map 11)

Timora zernytamsia Berio, 1939 : 60. Holotype ♀, SOMALI REPUBLIC: Belet, 15.vii.1934 (*Patrizi*) (MCSN, Genoa).

Fore wing, length ♂ (12), 11·8–14·7, ♀ (14), 14·0–15·5. Wing pattern as in Pl. 10, fig. 230. Fore wing upper surface with ground colour yellowish white to pale yellow, anal region occasionally irrorate with brown; postmedial and terminal dots and lower central longitudinal streak brown. Hind wing upper surface white to yellowish white.

MATERIAL EXAMINED.

ETHIOPIA: El Dire, Sagan-Omo, 1 ♀, in MCSN, Genoa; Dire Daoua, 10 ♂, 13 ♀, xii.1934, or iv.–ix.1935 (*H. Uhlenhuth*); KENYA: Isiolo, 2 ♂, (*H. Copley*).

DISTRIBUTION (Map 11). Somali Republic (type-locality), Ethiopia and Kenya.

REMARKS. Morphological differences between *M. p. zernytamsia* and *M. p. perstriata* have not been found. They occur in different regions, *M. p. zernytamsia* in Africa, *M. p. perstriata* in India. Lying between them geographically is the third subspecies, *M. p. fuscostriata* (Map 11). *M. p. zernytamsia* and *M. p. fuscostriata* are separable on the presence and absence, respectively, of a row of fore wing terminal dots.

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Synonyms in italics, page references to descriptions in bold type

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Cromwell Road
London, SW7 5BD

PLATE 1

FIG. 114. *philbyi* ♂ (B.M. Neg. 47118).
FIG. 115. *philbyi* ♀ (B.M. Neg. 47120).
FIG. 116. *philbyi* ♂ (B.M. Neg. 47119).
FIG. 117. *philbyi* ♀ (B.M. Neg. 47121).
FIG. 118. *fissifascia fissifascia* ♂ holotype (B.M. Neg. 43209).
FIG. 119. *fissifascia roseata* ♀ paratype (B.M. Neg. 43208).
FIG. 120. *decorata decorata* ♂ lectotype (B.M. Neg. 43637).
FIG. 121. *decorata decorata* ♀ (B.M. Neg. 47130).
FIG. 122. *decorata decorata* ♀ (B.M. Neg. 47129).
FIG. 123. *decorata albiseriata* ♂ (B.M. Neg. 47133).
FIG. 124. *decorata metarhoda* ♀ (B.M. Neg. 47131).
FIG. 125. *decorata metarhoda* ♀ (B.M. Neg. 47132).

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PLATE 2

FIG. 126. *leucosticta leucosticta* ♂ (B.M. Neg. 47125).
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FIG. 128. *leucosticta leucosticta* ♀ (B.M. Neg. 47122).
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FIG. 134. *sublimis* ♂.
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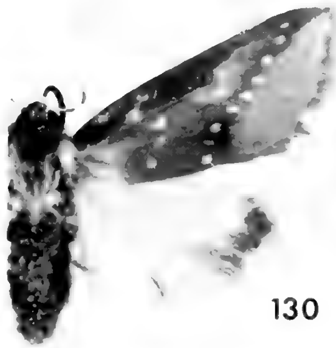

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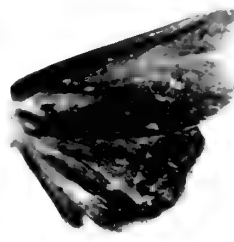

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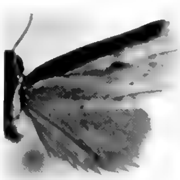

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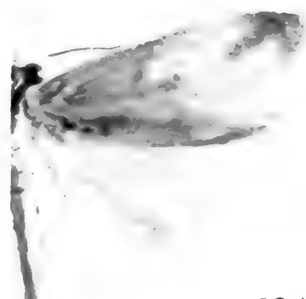

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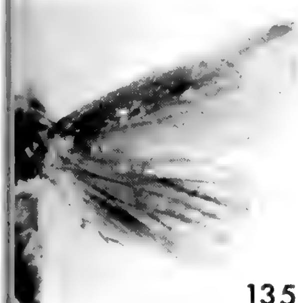

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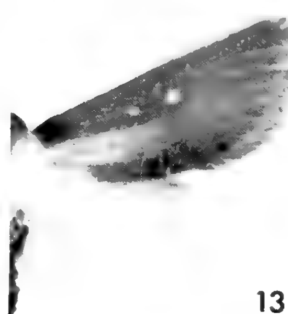

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Fig. 138. *galatheae galatheae* form *galatheae* ♂ (Indian specimen) (B.M. Neg. 47104).
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Fig. 146. *galatheae bechuana* ♀ paratype (B.M. Neg. 47119).
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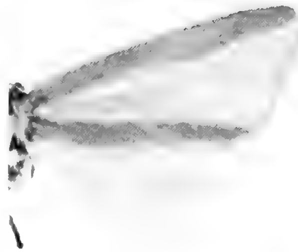

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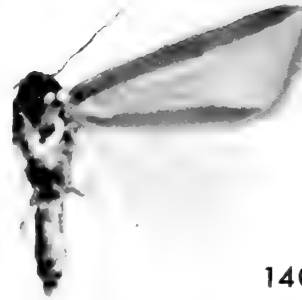

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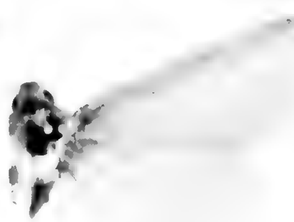

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PLATE 4

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FIG. 151. *cruentata* ♂ (B.M. Neg. 47115).
FIG. 152. *cruentata* ♀ (B.M. Neg. 47118).
FIG. 153. *hololeuca* ♂ (B.M. Neg. 47192).
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FIG. 155. *radiata radiata* ♂ lectotype (B.M. Neg. 43626).
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FIG. 157. *radiata terracotta* ♂ lectotype (B.M. Neg. 43224).
FIG. 158. *radiata terracotta* ♀ (B.M. Neg. 51475).
FIG. 159. *flaviceps* ♂ (B.M. Neg. 47137).
FIG. 160. *epimethea* ♀ (B.M. Neg. 47193).
FIG. 161. *epimethea* ♂ (B.M. Neg. 46274).

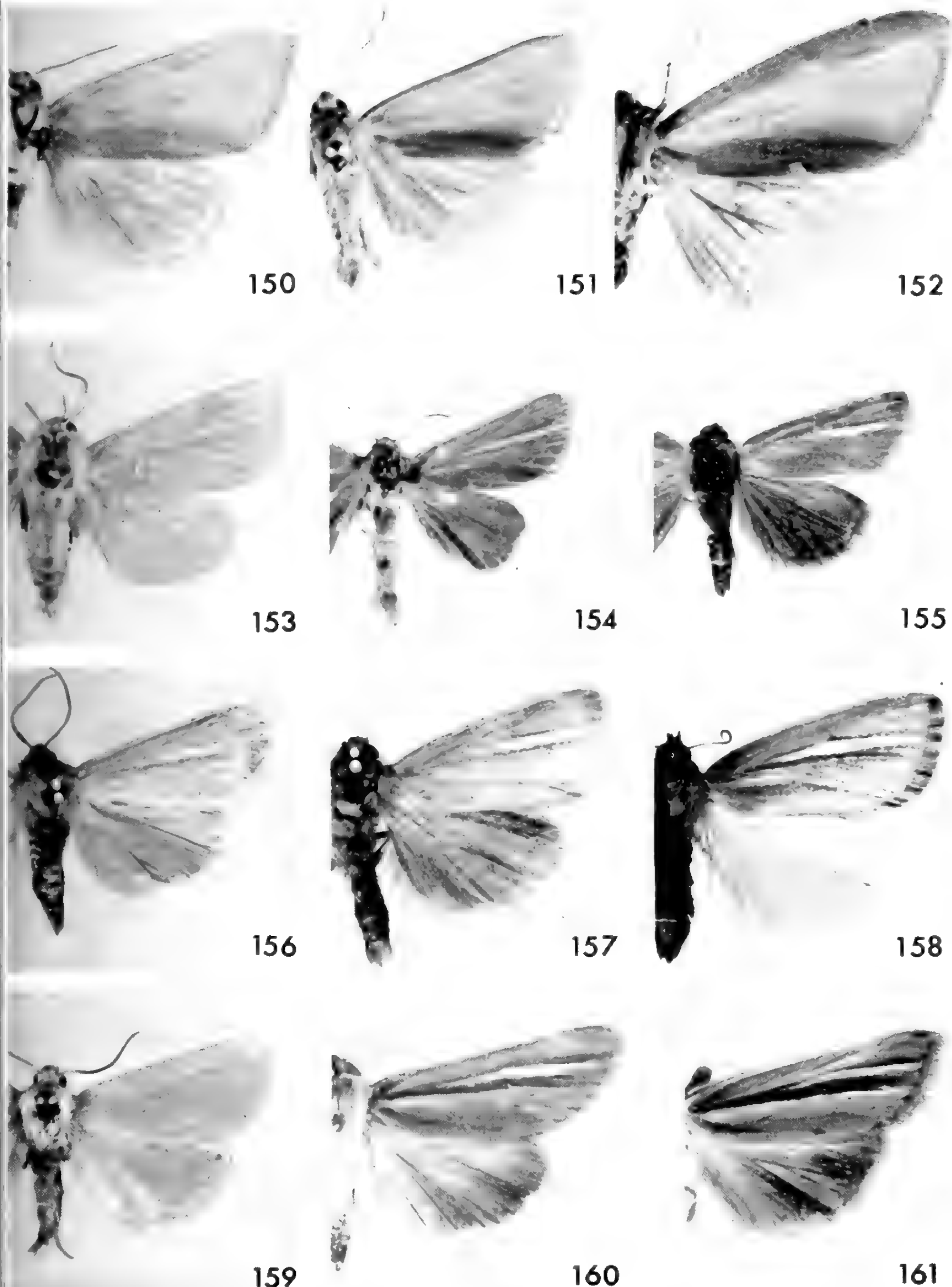
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PLATE 5

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FIG. 163. *rubristria rubristria* ♂ (specimen from Fort Crampel, Central African Republic) (B.M. Neg. 47181).
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FIG. 165. *rubristria rubristria* ♂ (specimen from Navaro, Ghana) (B.M. Neg. 47184).
FIG. 166. *rubristria transvaalica* ♂ lectotype (B.M. Neg. 43226).
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FIG. 172. *terracottoides* ♀ (B.M. Neg. 47148).
FIG. 173. *terracottoides* ♂ holotype (B.M. Neg. 43210).


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PLATE 6

FIG. 174. *beatrix beatrix* ♂ (B.M. Neg. 47184).
FIG. 175. *beatrix beatrix* ♂ (B.M. Neg. 47190).
FIG. 176. *beatrix beatrix* ♀ (B.M. Neg. 47191).
FIG. 177. *beatrix trifasciata* ♂ (B.M. Neg. 47176).
FIG. 178. *beatrix trifasciata* ♀ holotype (B.M. Neg. 47177).
FIG. 179. *rosacea* ♂ lectotype (B.M. Neg. 47140).
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FIG. 181. *roseivena* ♂ holotype (B.M. Neg. 43228).
FIG. 182. *roseivena* ♂ (B.M. Neg. 43229).
FIG. 183. *roseivena* ♂ (B.M. Neg. 47134).
FIG. 184. *roseivena* ♀ (B.M. Neg. 47135).
FIG. 185. *semifusca* ♀ holotype (B.M. Neg. 47174).

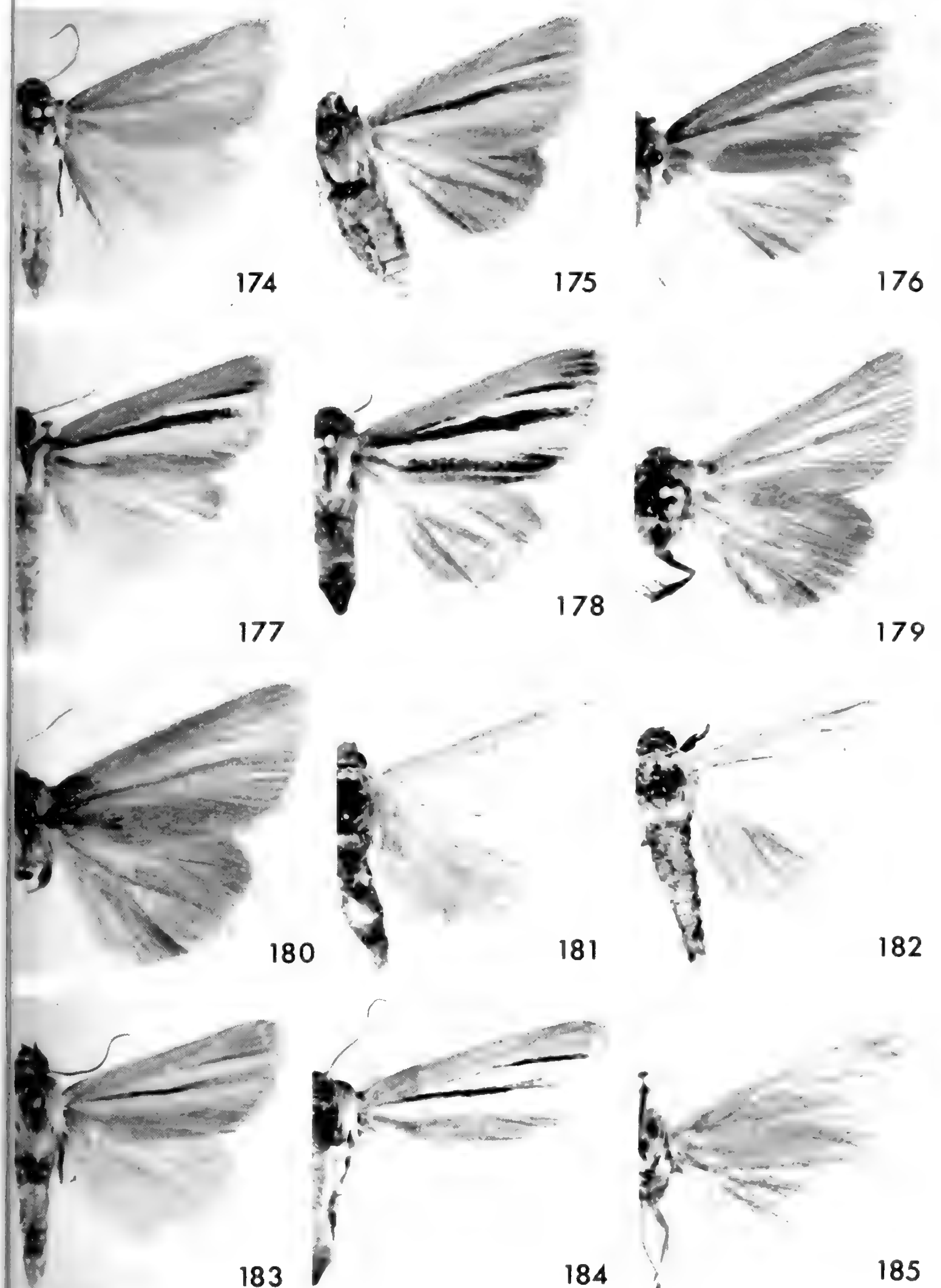
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PLATE 7

FIG. 186. *flavistrigata* ♂ (*lineata* lectotype).
FIG. 187. *flavistrigata* ♂ (B.M. Neg. 47144).
FIG. 188. *flavistrigata* ♂ (B.M. Neg. 47143).
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FIG. 197. *albicilia* ♂ (B.M. Neg. 47178).


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FIG. 198. *albipuncta* ♂ lectotype (B.M. Neg. 43644).
FIG. 199. *albipuncta* ♀ (B.M. Neg. 47188).
FIG. 200. *quilengesi* ♂ holotype (B.M. Neg. 47101).
FIG. 201. *quilengesi* ♀ paratype (B.M. Neg. 47102).
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FIG. 204. *nubila* ♀ (B.M. Neg. 47171).
FIG. 205. *nubila* ♀ (*chrysita* lectotype).
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FIG. 209. *tosta* ♀ lectotype (B.M. Neg. 47173).


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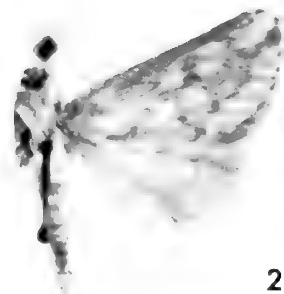
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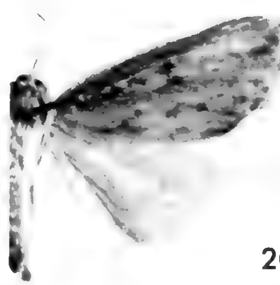
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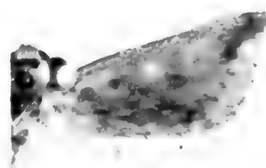
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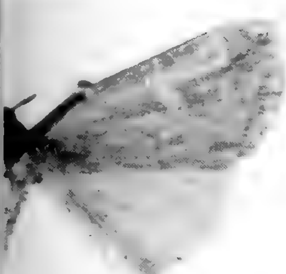
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PLATE 9

FIG. 210. *bimaculata bimaculata* ♂ holotype (B.M. Neg. 47151).
FIG. 211. *bimaculata bimaculata* ♀ (B.M. Neg. 47152).
FIG. 212. *bimaculata cornia* ♂ paratype (B.M. Neg. 47155).
FIG. 213. *bimaculata cornia* ♀ paratype (B.M. Neg. 47154).
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FIG. 217. *bimaculata nigrifasciata* ♀ (intergrade) (B.M. Neg. 47162).
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FIG. 221. *bimaculata pluritelifora* ♂ (B.M. Neg. 47157).
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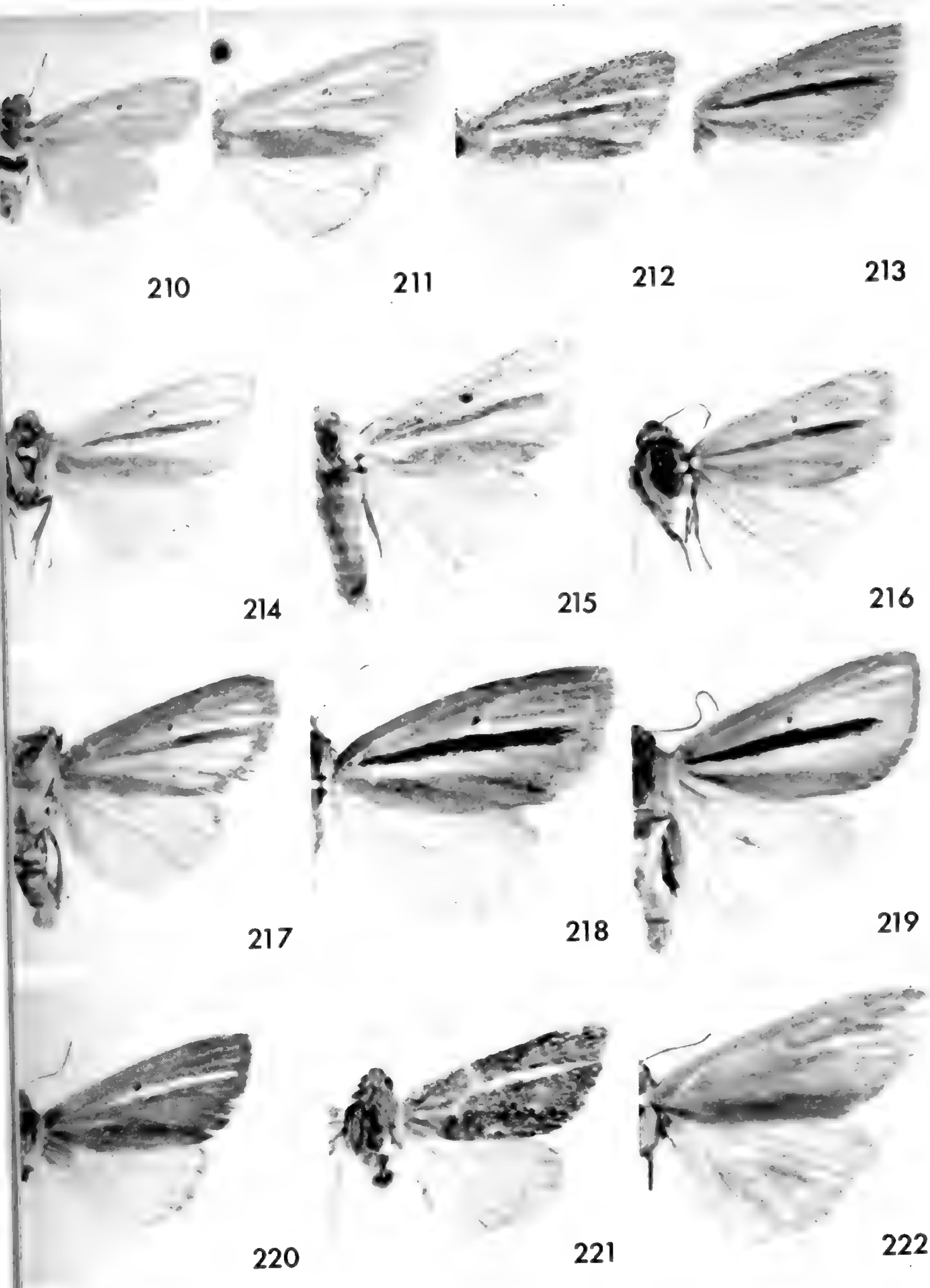

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PLATE 10

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FIG. 224. *albida* ♂ (B.M. Neg. 47098).
FIG. 225. *albida* ♂ (B.M. Neg. 47100).
FIG. 226. *perstriata fuscostriata* ♀ paralectotype.
FIG. 227. *perstriata fuscostriata* ♂ paralectotype.
FIG. 228. *perstriata fuscostriata* ♀ (from type-series)
FIG. 229. *perstriata perstriata* ♂ holotype (B.M. Neg. 47163).
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FIG. 231. *artaxoides* ♂ (B.M. Neg. 47175).
FIG. 232. *metaphaea* ♀ (B.M. Neg. 47136).
FIG. 233. *mittoni* ♂ lectotype (B.M. Neg. 43215).
FIG. 234. *modesta* ♂ (*calamaria* lectotype) (B.M. Neg. 43652).

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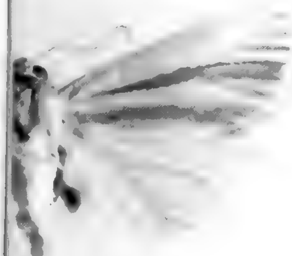

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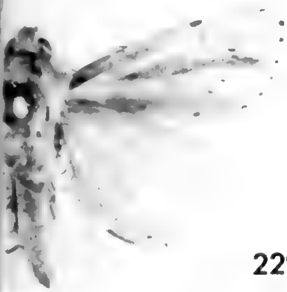

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A TAXONOMIC REVIEW OF THE SPECIES OF *CINARA* CURTIS OCCURRING IN BRITAIN (HEMIPTERA: APHIDIDAE)

V. F. EASTOP

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 27 No. 2
LONDON: 1972

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BY

VICTOR FRANK EASTOP

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BULLETIN OF
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ENTOMOLOGY Vol. 27 No. 2
LONDON : 1972

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A TAXONOMIC REVIEW OF THE SPECIES OF *CINAR* CURTIS OCCURRING IN BRITAIN (HEMIPTERA: APHIDIDAE)

By V. F. EASTOP

CONTENTS

SYNOPSIS

Keys are given for the identification of the viviparous morphs of the 21 species of *Cinara* known from Britain. Biometric data for each species are tabulated and a summary is given of their known host-plant range, geographical distribution and biology. Six specific synonyms are newly established and one former variety (*stroyani* Pašek) is raised in status to species.

INTRODUCTION

THE purpose of this paper is to provide a means of identifying the species of *Cinara* occurring in Britain. As understood here, *Cinara* includes *Cupressobium* and contains about 200 described species living on Coniferae of the families Pinaceae and Cupressaceae. About 150 of the species are described from North America, 20 from Japan and the Oriental region and 30 are European or Mediterranean in origin. Twenty-one species have been seen from Britain, but not more than five of these can be native since the other 16 species live on introduced host-plants.

Most of the introduced aphids are from central Europe and British material fits central European descriptions. There appears to be another fauna south of the Alps, as it is difficult to relate British material to the descriptions of the Italian fauna by Del Guercio (1909) and to the Spanish fauna by Gomez Menor (1962).

Recent accounts of the species of *Cinara* from various parts of Europe (Pašek, 1952–1954; Heinze, 1962; Szelegiewicz, 1962; Pintera, 1966) have made it much easier to identify the British species. Recent authors have made great use of the chaetotaxy of the processus terminalis of the last antennal segment and the shape of the first segment of the hind tarsus. As the last antennal segments and hind legs of trapped alatae of *Cinara* are often lost and as no previous account includes all the British species, this paper started as an attempt to construct a key to alatae using characters on less deciduous structures, such as the rostrum and abdomen.

The principal recent works on the taxonomy of *Cinara* include Braun, 1938 : 461–510, Börner, 1949 : 52–60, Heinze, 1962 : 145–178, Central Europe; Pašek, 1954 : 1–319 and Pintera, 1966 : 281–321, Czechoslovakia; Szelegiewicz, 1962 : 63–98, Poland; Shaposhnikov, 1964 : 521–524, European U.S.S.R.; Bodenheimer & Swirski, 1953 : 182–183, 245–246, Middle East; Narzikulov, 1962 : 111–118, Central Asia; Inouye, 1970 : 57–102, Japan; Paik, 1965 : 16–22, Korea; Takahashi, 1931 : 22–24, Taiwan; Blanchard, 1939 : 859–870, Argentina; Tissot, 1939 : 34–47, Florida; Palmer, 1952 : 20–52, Rocky Mountains. Hottes has published many papers on North American *Cinara* between 1930 and 1965. G. A. Bradley, 1956–1968, has published a series of papers on Canadian *Cinara* but his monograph has not yet appeared. Eastop, 1961 : 74–75 & 1966 : 525–529 gave keys to the species of *Cinara* introduced to Africa and Australia respectively.

NOMENCLATURE

There has been confusion about the use of *Lachnus* Burmeister and *Cinara* Curtis because both were described in 1835 and there was doubt about the identity of the type-species of both genera. As a result various replacement names were proposed but subsequently proved unnecessary. Hottes (1930 : 185–188) and Theobald (1929 : 352) discuss the usage of *Cinara* and *Lachnus*.

Although *Aphis pini* L. has been accepted as the type-species of *Cinara* for the last 40 years, there has been a dispute as to the species of *Cinara* to which the name *pini* L. should be applied. Stroyan (1955 : 332–333) summarizes the position.

GENERIC SYNONYMY

CINARA Curtis, 1835

[*Aphis* L., partim, auctores diversi, 1758–1852.]

[*Lachnus* Burmeister, partim, auctores diversi, 1835–1933.]

**Cinara* Curtis, 1835 : part 576. Type species: *Aphis pini* L., 1758 : 453.

**Lachniella* Del Guercio, 1909 : 286. Type-species: *Lachnus fasciatus* Burmeister, 1835 = *costata* Zetterstedt, 1828.

**Todolachnus* Matsumura, 1917 : 381. Type-species: *Todolachnus abietis* Matsumura, 1917 : 381–382.

Wilsonia Baker, 1919*a* : 212, nec Bonaparte, 1838. Type-species: *Lachniella gracilis* Wilson, 1919 : 20–21.

Dilachnus Baker, 1919*b* : 253, nec Fairmaire, 1896. Type-species: *Lachniella gracilis* Wilson, 1919 : 20–21.

Panimerus Laing in Theobald, 1929 : 129, nec Eaton, 1913. Type-species: *Lachniella gracilis* Wilson, 1919 : 20–21.

**Neochmosis* Laing in Theobald, 1929 : 129, footnote. Type-species: *Lachniella gracilis* Wilson, 1929 : 20–21.

Neodimosis Toth, 1935 : 495. [Incorrect subsequent spelling of *Neochmosis* Laing.]

**Cinaria* Börner, 1939 : 76. Type-species: *Aphis laricis* Walker.

**Cinarina* Börner, 1939 : 76. Type-species: *Lachnus viridescens* Cholodkovsky = *bogdanowi* Mordwilko.

**Cinaropsis* Börner, 1939 : 76. Type-species: *Lachnus pinicola* Kaltenbach, 1843, sensu Börner = *pilicornis* Hartig.

**Dinolachnus* Börner, 1940 : 1. Type-species: *Lachniella cilicica* var. *cecconii* Del Guercio = *abieticola* Cholodkovsky.

**Cupressobium* Börner, 1940 : 1. Type-species: *Aphis juniperi* De Geer.

**Cinarella* Hille Ris Lambers, 1948 : 275 [as subgenus of *Cinara* Curtis]. Type-species: *Lachnus pineus* Mordwilko.

**Subcinara* Börner, 1949 : 59 [as subgenus of *Cinara* Curtis]. Type-species: *Cinara brauni* Börner.

Cinarella Börner, 1949 : 59, nec Hille Ris Lambers, 1948 [as subgenus of *Cinara* Curtis]. Type-species: *Cinara laricicola* Börner, 1939 nec Matsumura, 1917 = *boerneri* Hille Ris Lambers.

**Laricaria* Börner, 1949 : 59 [as subgenus of *Cinaria* Börner]. Type-species: *Cinara kochiana* Börner.

Pityaria Börner, 1949 : 59 [as subgenus of *Cinaria* Börner]. Type-species: '*Lachnus pruinosus* Htg. = *bogdanowi* Md.'

**Mecinaria* Börner, 1949 : 59 [as subgenus of *Cinaria* Börner]. Type-species: *Aphis piceae* Panzer.

**Cinarellia* Börner, 1951 : ?; 1952 : 41. Type-species: *Cinara laricicola* Börner, 1939 (nec Matsumura, 1917) = *boerneri* Hille Ris Lambers. Börner, 1952 : 41 lists *Cinarellia* Börner, 1951 with *Cinarella* Börner, 1949 nec Hille Ris Lambers, 1948, as a synonym but gives no reference to the 1951 paper and I have not been able to find it.

**Buchneria* Börner, 1952 : 41, 242. Type-species: *Aphis pectinatae* Nördlinger.

[*Eulachnus* Del Guercio, Börner, 1952 : 241. Börner considered *Eulachnus mingazzinii* Del Guercio (= *piniphila* Ratzeburg) to be the type-species of *Eulachnus* Del Guercio. However, the International Commission on Zoological Nomenclature has since ruled that the type-species is *Lachnus agilis* Kaltenbach (*Bull. zool. Nom.* **22** : 188–189, 1965), and so *Eulachnus* is not a synonym of *Cinara* and is available in its most widely used sense with *Protolachnus* Theobald as a synonym.]

Neocinaria Pašek ms [as subgenus of *Cinaria* Börner]. Type-species: *Cinara escherichi* Börner [see Pintera, 1966 : 281–282].

Pseudocinara Pašek, ms [as subgenus of *Cinara* Curtis]. Type-species: *Lachnus neubergi* Arnhardt [see Pintera, 1966 : 282].

The names marked with an asterisk (*) are available for subgenera.

Alphabetical list of the type-species of the subgenera and synonyms of *Cinara*.

abieticola Cholodkovsky, 1899. Type of *Dinolachnus* Börner, 1940 (as *cilicica* var. *cecconii*).

abietis Matsumura, 1917. Type of *Todolachnus* Matsumura, 1917.

boerneri Hille Ris Lambers, 1956. Type of *Cinarella* Börner, 1949 (nec *Cinarella* Hille Ris Lambers, 1948) and *Cinarellia* Börner, 1951/1952, as *laricicola* Börner, 1939 nec Matsumura, 1917.

bogdanowi Mordwilko, 1895. Type of *Cinarina* Börner, 1939 (as *viridescens*) and *Pityaria* Börner, 1949 (as *pruinosus*).
brauni Börner, 1940. Type of *Subcinara* Börner, 1949.
cilicica var. *cecconii* Del Guercio = *abieticola* Cholodkovsky.
costata Zetterstedt, 1828. Type of *Lachniella* Del Guercio, 1909 (as *fasciata*).
escherichi Börner, 1950. Type of *Neocinara* Pašek, m.s.
fasciata Burmeister, sensu Del Guercio, 1909 = *costata* Zetterstedt.
gracilis Wilson, 1919. Type of *Wilsonia* Baker, 1919 (nec *Wilsonia* Bonaparte, 1838 etc.); *Dilachnus* Baker, 1919 (nec Fairmaire, 1896); *Panimerus* Laing, 1929 (nec Eaton, 1913) and *Neochmosis* Laing, 1929.
juniperi De Geer, 1773. Type of *Cupressobium* Börner, 1940.
kochiana Börner, 1939. Type of *Laricaria* Börner, 1949.
laricicola Börner, 1939 nec Matsumura, 1917 = *boerneri* Hille Ris Lambers.
laricis Walker, 1848. Type of *Cinaria* Börner, 1939.
neubergi Arnhardt, 1930. Type of *Pseudocinara* Pašek, m.s.
pectinatae Nördlinger, 1880. Type of *Buchneria* Börner, 1952.
piceae Panzer, 1801. Type of *Mecinaria* Börner, 1949.
pilicornis Hartig, 1841. Type of *Cinaropsis* Börner, 1939 (as *pinicola*).
pineus Mordwilko, 1895. Type of *Cinarella* Hille Ris Lambers, 1948.
pini L., 1758. Type of *Cinara* Curtis, 1835.
pinicola Kaltenbach, 1843 sensu Börner = *pilicornis* Hartig.
pruinosus Hartig, 1841 sensu Börner = *bogdanowi* Mordwilko.
viridescens Cholodkovsky, 1898 = *bogdanowi* Mordwilko.

SYSTEMATICS

The European species of *Cinara* fall into fairly well defined groups which have been dignified as genera and subgenera. The British species could be arranged as in the table on page 175. Although there are evident groups of species when the world fauna is considered, I have not been able to find characters to separate them absolutely. For instance, *Cinara konoi* Inouye, *C. longipennis* (Matsumura) and *C. todocolus* Inouye from the Far East, *C. chinookiana* Hottes, *C. lasiocarpae* (Gillette & Palmer) and *C. sonata* Hottes from America all resemble *C. abieticola* (Cholodkovsky) and live on *Abies*, suggesting that *Dinolachnus* should be regarded as at least subgenerically distinct. *Cinara sonata*, however, has four sub-apical setae on the processus terminalis and a rim around the primary rhinaria, just the characters distinguishing *Cinara* s. str. from the other *Dinolachnus*. *Cinara* (*Lachniella*) *costata* (Zetterstedt) from *Picea* in the palaearctic region has characteristically pigmented wings and short first tarsal segments, as does *C.* (*L.*) *comata* Doncaster from the Himalayas. The dorsal length of the first tarsal segments of their hind legs is only about 0·6–0·8 of the basal diameter, and about 0·25–0·33 of the ventral length of the segment. In *C.* (*L.*) *nimbata* Hottes from *Picea engelmanii* in North America the dorsal length of the first tarsal segments of the hind leg is about 1·2–1·5 times as long as its basal diameter and about 0·4 of its ventral length. Apart from bearing rather shorter hairs, *C.* (*L.*) *nimbata* is otherwise similar to *C.* (*L.*) *costata*. *Cinara difficilis* Hottes from *Juniperus* in North America has short

first tarsal segments and long fine hairs like a *Cupressobium*, but has a a rim round the primary rhinaria and bears five sub-apical setae on the processus terminalis. *C. manitobensis* Bradley from *Juniperus* in North America has four sub-apical setae on the processus terminalis, a rim round the primary rhinarium and the appearance of a *Cinaropsis*. *Cinara coloradensis* (Gillette) and *C. hottesi* Gillette & Palmer live on *Picea* in North America but resemble the *C. pini* group (= *Cinara* s. str.) which are confined to *Larix* and *Pinus* in Europe. I have not been able to find any satisfactory subgeneric separation for the world fauna.

Heie (1967 & 1969) gives a comprehensive account of the aphids known from baltic amber, which is thought to be the petrified resin of *Pinites succinifera* Goeppert, an extinct conifer related to *Pinus*. Heie studied 103 aphids from amber without finding a single member of the subfamily Lachninae to which *Cinara* belongs. *Pinites* resin may have been more sticky in the rather warmer conditions of the lower Oligocene than *Pinus* resin is today. The absence of *Cinara* from present-day resin on English conifers may be due to resin being most sticky in high summer when *Cinara* are little evident, being either subterranean or perhaps in reproductive diapause. I have not been able to find insects trapped in resin on living conifers in order to compare them with the aphid fauna of the tree. Under English conditions, conifer resin usually occurs only in small quantities, and the surface is not sticky. The large size, complete wing venation, dense pubescence, trace of a third tarsal segment, distinct 4th and 5th rostral segments, compound eyes in all forms, absence of host-plant alternation and association with coniferae are characters suggesting that *Cinara* belongs to an old group of aphids. The absence of Lachninae from baltic amber, however, and the short straight radius arising from near the tip of the stigma of the fore wing suggest that the group is more recent.

GENERIC DIAGNOSIS

Medium-sized to large aphids, body 2–8 mm long. General appearance as in Text-fig. 28 (p. 154). Yellowish, red-brown, dark brown or sometimes green aphids. Antennal tubercles absent. Antennae 6-segmented, 0·2–0·6 as long as the body. Processus terminalis short, 0·08–0·33 as long as the base of the sixth antennal segment and bearing 3 apical and 2–11 sub-apical setae. Apterae usually with a rhinarium at the apex of the fourth antennal segment and often also with a secondary rhinarium on the fifth segment just basad of the primary rhinarium. Alatae viviparae with secondary rhinaria distributed: III, 1–18; IV, 0–6; V, 0–4; VI, 0. Antennae, body and legs often covered with numerous long fine hairs (Text-figs 1, 19, 28–31, 38–39) or the hairs may be shorter and only about equal in length to the diameter of the third antennal segment (Text-figs 6, 18, 22). Rostrum evidently consisting of five segments, the suture between segments 4 and 5 distinct (Text-figs 4, 9, 10, 25, 36). The fourth rostral segment bears from 2 to 60 accessory hairs but most species bear 4–14 accessory hairs arranged in two rows bordering the groove for the stylets. Wing venation as in Text-figs 13, 20, 37; the radius originates from the end of the pterostigma and extends in a straight line to the wing apex. Hind wing with two oblique veins. Tarsi 2-segmented but when the basal segment is long as in the subgenus *Cinarella*, it often bears traces of a suture suggest-

ing that it is composed of two fused segments. The first tarsal segment bears nine or more ventral hairs and the second segment bears eight or more long dorsal hairs and about 16 shorter ventral hairs. Empodial hairs very short, only about 0·1 times as long as the claws. Mid thoracic furca of apterae with a short base.

Siphunculi placed on pigmented cones whose diameter varies with the degree of pigmentation but is often about equal to the length of the third antennal segment. Cauda crescent-shaped and bearing about 20 hairs. Eighth abdominal tergite bearing 7–77 hairs.

TAXONOMY

The ratios of the fifth antennal segment to the other antennal segments have been used to recognize species. The fifth antennal segment tends to increase in size more with increased body size than does the sixth antennal segment. Thus the antennal V : VI ratio tends to increase with body size and the differences between large and small specimens are greatest in species with the greatest differences between the lengths of the segments. In *Cinara laricis* and *C. piceae* with a relatively long antennal V, the V : VI ratio of large specimens varies from 1·9–2·4 and for *C. abieticola* from 1·9–2·2, while the ratio varies from 1·2–1·5 in small specimens of all three species. In species where antennal VI is as long as or longer than V (*Cupressobium*, *Lachniella*, *Buchneria*), V and VI increase in length more or less in unison and in proportion to the body length. These species have an antennal V : VI ratio of 0·7–1·1 over their whole size range. In species with antennal V only a little longer than VI, such as *C. pini*, *C. bogdanowi*, *C. pilicornis* (i.e. ± *Cinara* s. str. and *Cinaropsis*), the large specimens have the antennal V : VI ratio varying from 1·3–1·8 and the small specimens from 1·0–1·4.

The adults, particularly of fundatrices and oviparae, may look similar to fourth instar larvae. The adult form can be recognized by the shape of the sub-genital plate. The rudimentary gonopophyses are also a sign of maturity but are sometimes difficult to detect in adults and may sometimes be detected before the final moult.

Fundatrices usually have shorter antennae and legs than the later generations and the processus terminalis is particularly short. The fundatrices often bear more abdominal hairs than later generations but sometimes bear fewer hairs on the second and sixth antennal segments than later generations. *Cinara piceae* is unusual in that the fundatrices tend to bear fewer abdominal hairs as well as fewer hairs on the fourth rostral segment and second antennal segment than in the summer generations. *Cinara piceae* is also unusual in that while oviparae are common, males are unknown. The fundatrices of *C. piceae* may arise from unfertilized eggs or be fundatrices spuriae derived from an as yet undetected overwintering larva. The apterous summer generations of some species bear a well developed mesosternal tubercle (Text-fig. 11, p. 127) but the tubercle is absent or only weakly developed in the spring generations of these species.

The eighth abdominal tergite of the oviparae may be pale but in *Cinara boerneri* it bears a small amount of pigmentation similar to the apterae viviparae. In the viviparae of most species of *Cinara* the eighth abdominal tergite is well pigmented. The sub-genital plate of the oviparae is large and densely hairy and there is often

a group of latero-ventral hairs on either side of the eighth abdominal tergite. The hind tibiae of the oviparae are slightly thickened and bear numerous pseudosensoria in the species with alate males. The hind tibiae of the oviparae of *C. acutirostris*, which has apterous males, are devoid of pseudosensoria Samples of oviparae of *C. boerneri* collected together with males show evident pseudosensoria but in one sample in which only oviparae were collected the pseudosensoria are indistinct. In oviparae of *C. kochiana* the pseudosensoria are present but indistinct even when males are present.

The male genitalia of *Cinara boerneri* (Text-figs 14–16), *C. cupressi* (Text-fig. 21) and of *C. pectinatae* (Text-fig. 26) may be characteristic for each species. The problem when using male genitalia for aphid taxonomy is that, being soft, preparations from the same sample (Text-figs 14–16) may look different merely through lying in different positions.

Descriptions of each species are not given individually but biometric data for apterae and alatae viviparae and discriminants for apterae and alatae viviparae are given in the tables between pages 172–173. Data for sexuales are given in the table on page 175.

BIOLOGY

As far as is known *Cinara* species live only on Coniferae and usually only on Pinaceae and Cupressaceae. Most of the species living on Pinaceae are specific to one or to a few closely related species of *Abies, Larix, Picea* or *Pinus*. No species are known which live on more than one of these genera although some species normally living on *Abies* can breed successfully on *Cedrus*. Some *Cinara* living on Cupressaceae have a wider host-plant range, occurring on species in several genera of conifers although often not on all the species in these genera. For instance the usual hosts of *Cinara cupressi* are *Cupressus macrocarpus, Thuja occidentalis* and *Juniperus virginiana*. This host-plant range may only be a reflection of the lower level of agreement among botanists of the generic classification of Cupressaceae compared with the Pinaceae. *Cinara* species feed on the bark of their host-plants and some species are associated with lesions of Pine rust fungi (Tissot & Pepper, 1967 : 1–10). This association with rust fungi may be analogous with the habit of feeding on other insects galls found in other aphids in various systematic groups. The presence of the fungi may act as a physiological sink and like galls, stimulate the translocation of the metabolic products on which the aphids feed.

Most species of *Cinara* overwinter in the egg-stage from which an apterous fundatrix develops in the spring. The second or third generation is commonly winged and the summer may be spent on the roots of the same species of conifer on which the overwintering egg was laid. The remaining generations may be wingless or some alatae may occur from July onwards. In the autumn oviparae and winged or sometimes wingless males are produced. *Cinara piceae* is a widely distributed species in which oviparae have often been found but males are unknown. Some species of *Cinara* continue to reproduce on the aerial parts of their host all through the summer. Others remain on the aerial parts but adult apterae collected in late July or August may not contain fully developed embryos, which suggests

that reproductive diapause occurs. Many species of *Cinara* are associated with ants (Way, 1963 : 307–344). Several species of *Cinara* are of importance to bee-keepers in Central Europe as their honeydew is the source of 'forest honey'.

Key to the apterae viviparae of the British species of *Cinara*

1 Fourth rostral segment (Text-fig. 25) 330–420µ long, 2·4–3·0 times as long as the fifth rostral segment and bearing 24–32 accessory hairs arranged in 4 longitudinal rows of 6–8 hairs per row. Second antennal segment bearing 21–31 hairs. Base of sixth antennal segment (Text-fig. 23) bearing 15–24 hairs. Processus terminalis (Text-fig. 24) bearing 6–9 sub-apical setae. Mesosternal tubercle moderately developed. Second segment of hind tarsus 1·0–1·2 times as long as the fourth rostral segment. Fifth abdominal tergite bearing 18–30 hairs between the siphunculi. Longest hairs on the third abdominal tergite 15–25µ long. On *Larix* . . . . . . ***kochiana*** (p. 143)

– Fourth rostral segment 120–370µ long, 1·5–3·0 times as long as the fifth rostral segment and bearing 2–17 accessory hairs arranged in two longitudinal rows of 1–9 hairs per row. (Text-figs 4, 9, 10). Second antennal segment bearing 5–26 hairs. Base of the sixth antennal segment bearing 4–20 hairs and processus terminalis usually with only 3 or 4 sub-apical setae but sometimes with 5–11. If either the second antennal segment bears 20 or more hairs or the base of the sixth antennal segment bears 19 or more hairs (*abieticola, bogdanowi, stroyani*), then the fifth abdominal tergite bears 40–95 hairs between the siphunculi and the longest hairs on the third abdominal tergite are 60–270µ long. If the processus terminalia bears 5–11 subapical setae, then either the mesosternal tubercle is absent and the second antennal segment, base of the sixth antennal segment, fourth rostral segment, fifth abdominal segment between the siphunculi and the eighth abdominal tergite each bear only 5–17 hairs (*piceae, escherichi*) or if the fifth abdominal tergite bears 23–36 hairs between the siphunculi (*brauni*), then abdominal tergites 5–7 are fused in a solid dark patch 2

2 (1) Abdominal tergites 5–7 bearing a solid dark patch encompassing the siphuncular cones.

Processus terminalis 50–100µ long, 22–33% of the total length of the sixth antennal segment and bearing 5–7 sub-apical setae. Second segment of the hind tarsus 360–4430µ long, 1·1–1·5 times as long as the fourth rostral segment which is 250–320µ long. Eighth abdominal tergite bearing only 10–15 hairs, the longest of which are 140–180µ long. Longest hair on the third abdominal tergite 140–190µ long. Third antennal segment (Text-fig. 19) 500–700µ long and 4·5–9·5 times as long as the longest hair, 70–120µ, borne on it. On *Pinus nigra* . . . . ***brauni*** (p. 133)

– Pigmentation absent from tergites 5 and 6 or present only as isolated scleroites, any pigmentation present on each tergite being distinct from that on the other tergites.

Processus terminalis usually bearing only 3 or 4 sub-apical setae but if with 5–11 then the longest hair on the third abdominal tergite is 5–30µ long 3

3 (2) Some at least of the hairs on the anterior abdominal tergites arising from scleroites with a diameter several times that of the hair base.

Medium to large aphids, body 2·5–5·2 mm long, hind tibiae 1·5–3·5 mm long. Second antennal segment bearing only 5–10 hairs, base of the sixth antennal segment bearing 2–8 hairs. Fourth rostral segment bearing 4–8 accessory hairs. First segment of hind tarsus 2·9–5·7 times as long as its own basal width. Third, fourth and fifth antennal segments often without secondary rhinaria. On *Abies, Larix* and *Pinus* 4

– Scleroites absent or if present their diameter is less than 2·5 times that of the hair base 7

4 (3) Mesosternal tubercle (Text-fig. 11) present in the summer generations but sometimes only weakly developed or absent in the spring generations. Sixth antennal segment 100–160+ 22–37μ long. Ultimate rostral segment 150–210+ 80–100μ long. Second segment of hind tarsus 270–390μ long, 2·0–2·5 times as long as the first segment of the hind tarsus which is 110–180μ long and is 2·9–4·1 times as long as its own basal diameter. Fourth antennal segment often and fifth antennal segment usually bearing a secondary rhinarium. On *Larix* and *Pinus* 5

– Mesosternal tubercle absent. Sixth antennal segment 140–230+ 42–71μ long. Ultimate rostral segment 210–290+ 110–170μ long. Second segment of hind tarsus 350–530μ long, 1·4–2·0 times as long as the first segment of the hind tarsus which is 190–330μ long and 3·7–5·7 times as long as its own basal diameter. Third and fourth antennal segments usually and fifth often without secondary rhinaria. On *Abies and Pinus* 6

5 (4) Third antennal segment 6·5–13 times as long as the longest hair, 40–80μ, borne on it. Hind tibiae 1·5–2·9 mm long, 17–34 times as long as the longest hairs, 65–125μ borne on them. Fourth rostral segment 160–210μ long. Third antennal segment usually without a rhinarium, fourth antennal segment often without a rhinarium. Base of the sixth antennal segment bearing 4–7 hairs. Fifth abdominal tergite bearing 20–42 hairs between the siphunculi. Eighth abdominal tergite bearing 13–23 hairs. On *Larix*. ***laricis*** (p. 146)

– Third antennal segment 4·3–6·0 times as long as the longest hair, 110–150μ, borne on it. Hind tibiae 2·5–2·7 mm long, 14–16 times as long as the longest hairs, 170–190μ borne on them. Fourth rostral segment 150–160μ long. Third and fourth antennal segments each usually bearing a rhinarium. Base of the sixth antennal segment bearing 8–10 hairs. Fifth abdominal tergite bearing 40–50 hairs between the siphunculi. Eighth abdominal tergite bearing 20–24 hairs. On *Pinus sylvestris* . . ***pinihabitans*** (p. 162)

6 (4) Siphuncular cones (Text-fig. 33) 250–700μ in diameter. Third antennal segment 490–740μ long and 3·0–6·5 times as long as the longest hair, 90–210μ, borne on it. Fourth rostral segment 210–290μ long, 1·6–2·2 times as long as the fifth rostral segment, which is 110–170μ long. Hind tibia 1·8–3·4 mm long and 12–20 times as long as the longest hair, 120–230μ, borne on it. Longest hair on the third abdominal tergite 95–210μ, on the eighth abdominal tergite 130–200μ long. Eighth abdominal tergite bearing 23–28 hairs. Green aphid with paired dorsal longitudinal yellow stripes. On *Abies*. ***pectinatae*** (p. 148)

– Siphuncular cones (Text-fig. 33) 250–700μ in diameter. Third antennal segment 490–740μ long and 3·0–6·5 times as long as the longest hair, 90–210μ, borne on it. Fourth rostral segment 210–290μ long, 1·6–2·2 times as long as the fifth rostral segment, which is 110–170μ long. Hind tibia 1·8–3·4 mm long and 12–20 times as long as the longest hair, 120–230μ, borne on it. Longest hair on the third abdominal tergite 95–210μ, on the eighth abdominal tergite 120–230μ long. Eighth abdominal tergite bearing 13–26 hairs. Yellowish brown aphids bearing numerous darker brown spots. On *Pinus*. ***pinea*** (p. 156)

7 (3) Eighth abdominal tergite bearing 7–18 hairs. Fourth rostral segment 300–370μ long. Fifth abdominal tergite bearing 6–17 hairs between the siphunculi. Longest hairs on the third abdominal tergite 5–26μ and on the eighth abdominal tergite 45–130μ. Processus terminalis bearing 6–11 sub-apical setae.

Body length 3·2–6·7 mm. Hind tibiae 2·4–5·2 mm long and 36–84 times as long as the longest hair, 50–90μ, borne on them. Sub-genital plate bearing 40–80 hairs. On *Picea* . . . . ***piceae*** (p. 150)

– Eighth abdominal tergite bearing 7–77 hairs but if with less than 19 (*acutirostris, boerneri, cupressi, stroyani, pini, escherichi, fresai*) then the fourth rostral segment is 130–280μ long, and if more than 250μ long (*stroyani*) then the fifth abdominal tergite bears 40–90 hairs between the siphunculi and the longest hair on the third abdominal tergite is 60–150μ long . . . 8

8 (7) Fifth abdominal tergite bearing only 3–8 hairs between the siphunculi. Mesosternal tubercle well developed.

Longest hair on the third abdominal tergite 12–60μ long. Third antennal segment 400–700μ long, 6·5–15 times as long as the longest hair, 25–95μ, borne on it. Base of the sixth antennal segment 100–180μ long and bearing 8–16 hairs. Second antennal segment bearing 5–13 hairs. Eighth abdominal tergite bearing 7–23 hairs. Second segment of hind tarsus 210–320μ long, 2·0–2·6 times as long as the first segment of the hind tarsus, which is 90–150μ long, and 2·7–3·6 times as long as its own basal diameter. Second segment of hind tarsus 1·1–1·7 times as long as the fourth rostral segment, which is 140–250μ long and bears 6–10 accessory hairs. Hind tibia 1·5–3·3 mm long and 23–44 times as long as the longest hair, 40–120μ, borne on it. On *Pinus* 9

– Fifth abdominal tergite bearing 16–95 hairs between the siphunculi.
Mesosternal tubercle absent 11

9 (8) Processus terminalis bearing 5–7 sub-apical setae. Second antennal segment bearing 9–13 hairs. Eighth abdominal tergite bearing 14–23 hairs, the longest of which are 90–120μ long. Hairs on the third abdominal tergite 12–20μ long. Body 3·4–4·3 mm long. Hind tibiae 2·6–3·3 mm long. Third antennal segment 9·5–15 times as long as the longest hair borne on it, which is 40–70μ long.

Fourth rostral segment 210–230μ long, 2·0–2·4 times as long as the fifth rostral segment and bearing 8–11 accessory hairs. On *Pinus sylvestris*.
escherichi (p. 139)

– Processus terminalis bearing only 4 sub-apical setae. Second antennal segment bearing 5–10 hairs. Eighth abdominal tergite bearing 7–18 hairs. Longest hair on third abdominal tergite 15–33 or 45–60μ long. Either smaller, body 2·5–3·4 mm long, hind tibiae 1·6–2·5 mm long and bearing hairs 40–95μ long, third antennal segment 7·7–15 times as long as the longest hair, 25–80μ, borne on it, or body 3·5–4·1 mm long, hind tibia 2·7–3·2 mm long and bearing hairs 90–120μ long, and third antennal segment 6·5–9·5 times as long as the longest hair, 70–95μ long, borne on it 10

10 (9) Body 3·5–4·1 mm long. Hind tibia 2·7–3·2 mm long. Longest hair on third abdominal tergite 45–65μ long. Third antennal segment (Text-fig. 6) 550–650μ long, 6·5–9·5 times as long as the longest hair borne on it. Fourth rostral segment 210–250μ long (Text-figs 9 and 10). On *Pinus nigra*.
acutirostris (p. 128)

– Body 2·5–3·4 mm long. Hind tibiae 1·6–2·5 mm long. Longest hair on third abdominal tergite 15–35μ long. Third antennal segment 400–600μ long and 7·5–15 times as long as the longest hair, 25–80μ, borne on it. Fourth rostral segment 140–220μ long. On *Pinus sylvestris* . . . . ***pini*** (p. 160)

11 (8) Third abdominal tergite bearing hairs up to 12–35μ long. Processus terminalis 14–25% of the total length of the sixth antennal segment. Fourth rostral segment 150–210μ long. Hind tibiae 2–3 mm long and 30–35 times as long as the longest hair, 50–70μ, borne on them. Second segment of hind tarsus 360–460μ long, 2·1–2·7 times as long as the first segment of the hind

tarsus, which is 150–200μ long. Fifth abdominal tergite bearing 16–36 hairs between the siphunculi (Text-fig. 17). Primary rhinaria without chitinised rims. Third antennal segment (Text-fig. 18) without rhinaria. Hairs on the third antennal segment 20–70μ long and on the eighth abdominal tergite 60–100μ long. On *Larix* . . . **boerneri** (p. 129)

– Hairs on third abdominal tergite up to 45–270μ long, if less than 60μ then the processus terminalis is about 25% of the total length of the sixth antennal segment, the fourth rostral segment is 290–330μ long, the hind tibiae are 2–3 mm long and 15–30 times as long as the longest hair, 110–150μ, borne on them (*schimitscheki*). If the longest hair on the third abdominal tergite is 60–80μ long, then either *schimitscheki* as previously or *stroyani*, in which case the fifth abdominal tergite bears 40–90 hairs between the siphunculi, the primary rhinaria have chitinized rims, the fourth rostral segment is 210–280μ long, the third antennal segment usually bears a rhinarium and bears hairs up to 55–136μ long and the eighth abdominal tergite bears hairs up to 85–160μ long. On *Pinus nigra, Abies, Picea, Cedrus* and Cupressaceae . 12

12 (11) Body 4·6–8 mm long. Hind tibiae 3·3–5·5 mm long and 12–20 (rarely to 30) times as long as the longest hair, rarely 150–180μ but usually 260–330μ, borne on them. Third antennal segment (Text-fig. 1) 0·75–1·1 mm long and 2·5–4·5 times as long as the longest hair, 190–300μ borne on it. Base of the sixth antennal segment (Text-fig. 2) 230–290μ long and bearing 9–14 hairs. Processus terminalis (Text-fig. 3) 44–90μ long and bearing 3 or 4 sub-apical setae. Fourth rostral segment (Text-fig. 4) 270–350μ long, 2·1–2·6 times as long as the fifth rostral segment (120–150μ), and bearing 7–13 accessory hairs. Second segment of hind tarsus (Text-fig. 5) 380–500μ long and 2·5–3 times as long as the first segment of the hind tarsus, which is 130–180μ long. Third antennal segment without but fourth segment with 1–4 rhinaria. Primary rhinarium of the fifth antennal segment without a chitinized rim. Fifth abdominal tergite bearing 70–90 hairs between the siphunculi, eighth abdominal tergite bearing 25–45 hairs up to 190–360μ long. Siphuncular cones 460–990μ in diameter. On *Abies* spp. and sometimes *Cedrus* . . . . **abieticola** (p. 123)

– Body 1·7–5·0 mm long. Hind tibiae 0·9–3·0 mm long. Third antennal segment 250–950μ long. Base of the sixth antennal segment 110–230μ long. If body more than 4·5 mm long (*bogdanovi, pilicornis, schimitscheki* and fundatrices of *stroyani*) then the second segment of the hind tarsus is 1·6–2·5 times as long as the first segment of the hind tarsus (*bogdanovi & schimitscheki*) or 3·0–4·1 times as long as the first segment of the hind tarsus (*pilicornis*) or 2·6–3·1 times as long as the first segment of the hind tarsus but in this case the siphuncular cones are 210–370μ in diameter, the third antennal segment is only 440–520μ long and is 4·5–7 times as long as the longest hair, 70–100μ, borne on it, the base of the sixth antennal segment is only 130–150μ long, the processus terminalis is only 19–32μ long, the fourth rostral segment is only 220–250μ long, the fifth rostral segment is 90–110μ long, the hind tibiae are only 1·7–2·1 mm long and bear hairs up to 100–125μ long and the longest hair on the third abdominal tergite is 80–110μ long and on the eighth abdominal tergite is 125–155μ long. On *Pinus nigra, Picea* spp. and Cupressaceae . 13

13 (12) Second segment of hind tarsus 320–380μ long and 1·6–1·9 times as long as the first tarsal segment which is 170–220μ long and 3·5–4·1 times as long as its own basal diameter. Second segment of hind tarsus 0·9–1·2 times as long as the fourth rostral segment (Text-fig. 36) which is 290–340μ long and bears 6 accessory hairs. Second antennal segment bearing 9–13 hairs and base of the sixth antennal segment bearing 6–9 hairs.

Body 3·2–5·2 mm long and densely covered with small dark scleroites

(Text-fig. 35) with a diameter only a little greater than the hair bases they encircle. Third antennal segment 600–800μ long and 5·5–12 times as long as the longest hair, 70–120μ, borne on it. Hind tibiae 2–3 mm long and 15–30 times as long as the longest hairs, 110–150μ, borne on them. Longest hairs on the third abdominal tergite 45–100μ. Fifth abdominal tergite (Text-fig. 34) bearing 25–60 hairs between the siphunculi, eighth abdominal tergite bearing 25–65 hairs up to 95–130μ long. Third and fourth antennal segments without rhinaria. Processus terminalis 55–70μ long and about 25% of the total length, 210–270μ, of the sixth antennal segment. On *Pinus nigra* . . . . **schimitscheki** (p. 164)

– Second segment of hind tarsus 200–520μ long and 1·9–4·1 times as long as the first segment of the hind tarsus, which is 60–80μ long and 1·5–3·8 times as long as its own basal diameter. If the fourth rostral segment is more than 280μ long (*bogdanovi*) then it bears 9–13 accessory hairs and the second antennal segment and the base of the sixth antennal segment each bear 11–26 hairs. On *Picea* spp. and Cupressaceae 14

14 (13) Hind tibiae 1·3–2·7 mm long and 13–29 times as long as the longest hair, 70–165μ, borne on it. Third antennal segment 340–740μ long and 3·2–7·5 times as long as the longest hair, 55–145μ, borne on it. Fourth rostral segment 210–320μ long and bearing 6–13 accessory hairs. Primary rhinaria with a chitinised rim. On *Picea* 15

– Hind tibiae 0·9–2·2 mm long and 4–12 times as long as the longest hair, 140–280μ, borne on it. Third antennal segment 240–580μ long and 1·5–4·5 times as long as the longest hairs borne on it, which are sometimes only 80–100μ but are usually 100–250μ long; the ratio is more than 2·9 only in *pilicornis*. Fourth rostral segment 120–250μ long and bearing 2–8 accessory hairs. On *Picea* spp. and Cupressaceae 16

15 (14) Sub-genital plate bearing 18–33 hairs mostly placed laterally. Third antennal segment often without rhinaria but sometimes 1 or 2 are present. Second segment of hind tarsus 250–380μ long and 0·9–1·4 times as long as the fourth rostral segment, 240–320μ, which bears 9–13 accessory hairs **bogdanovi** (p. 132)

– Sub-genital plate bearing 33–65 hairs. Third antennal segment usually bearing 1–3 rhinaria but sometimes these are absent. Second segment of hind tarsus 310–470μ long and 1·2–1·9 times as long as the fourth rostral segment, which is 210–280μ long and bears 6–9 accessory hairs . **stroyani** (p. 165)

16 (14) Primary rhinaria with chitinized rims. Processus terminalis usually bearing 4 but sometimes only 3 sub-apical setae. Eighth abdominal tergite bearing 20–77 hairs up to 120–200μ long. Third antennal segment 250–530μ long, 2·0–4·5 times as long as the longest hair, 80–170μ, borne on it. On *Picea* . 17

– Primary rhinaria without chitinized rims. Processus terminalis usually bearing only 3 but sometimes 2 or 4, sub-apical setae. Eighth abdominal tergite bearing 16–31 hairs up to 120–260μ long. Third antennal segment 190–500μ long, 1·5–2·5 times as long as the longest hair, 110–250μ, borne on it. On Cupressaceae 18

17 (16) Second segment of hind tarsus 250–330μ long and 0·6–1·0 as long as the diameter of the siphuncular cones, 330–530μ. Third antennal segment 280–450μ long, 0·8–1·2 times as long as the diameter of the siphuncular cones and 2·0–2·8 times as long as the longest hairs, 140–170μ, borne on the third antennal segment . . . . **costata** (p. 134)

– Second segment of hind tarsus (Text-fig. 29) 300–520μ long, 1·2–2·5 times as long as the siphuncular diameter of 130–390μ. Third antennal segment (Text-fig. 30) 250–530μ long, 1·2–2·2 times as long as the siphuncular diameter and 2·3–4·5 times as long as the longest hairs, 80–150μ, borne on the third antennal segment . . . . **pilicornis** (p. 152)

18 (16) Hind tibiae dark only at the apex, the proximal three quarters pale. Processus terminalis 11–20% (exceptionally to 28%) of the total length of the sixth antennal segment. Base of the sixth antennal segment 110–170μ long and bearing 8–14 hairs extending over most of its length.

Longest hairs on the third antennal segment 110–170μ long, on third abdominal tergite 100–180μ and on the eighth abdominal tergite 120–190μ long. Second segment of hind tarsus 200–280μ long and 1·4–1·7 times as long as the fourth rostral segment, which is 140–180μ long and bears 5–8 accessory hairs. Yellow-brown or sometimes darker aphids, on the undersides of the branches, often near the trunk of *Callitris*, *Chamaecyparis*, *Libocedrus* and *Thuja orientalis* . . . . . . ***tujafilina*** (p. 166)

– Hind tibiae dark at both base and apex at least. Base of the sixth antennal segment 130–230μ long and 2·5–5 times as long as the processus terminalis 19

19 (18) Hind tibiae completely black or dark brown. Third antennal segment 240–410μ long, 0·5–1·1 (but rarely exceeding 0·9) times as long as the diameter of the siphuncular cone, 270–590μ.

Third antennal segment usually shorter than the fourth and fifth segments together. Fourth rostral segment 120–170μ long and bearing 3–5 accessory hairs. Processus terminalis 40–70μ long, base of the sixth antennal segment 150–230μ long and bearing 3–5 accessory hairs. Sub-genital plate bearing 19–27 hairs. Second segment of hind tarsus 250–350μ long, 3·1–4·0 times as long as the first segment of the hind tarsus, 70–100μ, and 1·8–2·4 times as long as the fourth rostral segment, which is 1·4–2·1 times as long as the first segment of the hind tarsus. On *Juniperus communis* . ***juniperi*** (p. 141)

– Hind tibiae with a paler area from about the basal one-fifth to half its length. Third antennal segment usually longer, ratio 0·7–1·7, than the diameter of the siphuncular cone. On *Cupressus* spp., *Thuja occidentalis* and *Juniperus* spp., other than *communis* 20

20 (19) Base of the sixth antennal segment 130–160μ long and bearing 4–7 (usually 5 or 6) hairs, which are confined to the basal half. Fourth rostral segment 120–170μ long, bearing 2–4 accessory hairs, and 1·4–1·9 times as long as the first segment of the hind tarsus. Sub-genital plate bearing 22–30 hairs. Smaller, body 2–3·5 mm long, pale reddish brown aphids on *Cupressus macrocarpus*, *Thuja occidentalis* and *Juniperus virginiana* . ***cupressi*** (p. 136)

– Base of the sixth antennal segment 140–200μ(–230μ in alatiform specimens) long and bearing 7–12 hairs extending over most of its length. Fourth rostral segment 160–240μ long, bearing 5–7 accessory hairs and 1·8–2·2 times as long as the first segment of the hind tarsus. Sub-genital plate bearing 28–44 hairs. Larger, body 2·2–4·2 mm long, dark brown aphids living on the under sides of the small branches of *Cupressus* and *Juniperus* spp. ***fresai*** (p. 140)

Key to the alatae viviparae of the British species of *Cinara*

1 Fourth rostral segment 300–400μ long and bearing 24–34 hairs arranged in 4 longitudinal rows. Processus terminalis bearing 5–8 subapical setae and second antennal segment bearing 21–32 hairs. Fifth abdominal tergite bearing 18–40 hairs between the siphunculi. Hairs on the 3rd abdominal tergite up to 30–60μ long.

Body length 4·5–5·5 mm long, third antennal segment 700–900μ long, 10–15 times as long as the longer hair, 60–80μ, borne on it. Fifth antennal segment 350–600μ long, 2·6–3·4 times as long as the base of the sixth antennal segment. Base of the sixth antennal segment bearing 15–22 hairs. Eighth abdominal tergite bearing 41–64 hairs, the more dorsal hairs being 35–60μ

long and the more lateral hairs on the eighth tergite are 85–130μ long. Scleroites absent or very small. On *Larix* . . . . **kochiana** (p. 143)

– Fourth rostral segment 130–380μ long, but bearing only 2–17 hairs which are arranged in only 2 longitudinal rows. Processus terminalis usually bearing only 3 or 4 subapical setae, if with 5–11, then second antennal segment bearing only 7–18 hairs, and if the fifth abdominal tergite bears more than 15 hairs between the siphunculi, then the hairs on the third abdominal tergite are up to 130–200μ long 2

2 (1) Large aphid, body length 4·5–6·5 mm. Hind tibia 4·0–6·4 mm and 65–120 times as long as the longest hair, 45–75μ, borne on it. Longest hair on the third abdominal tergite 35–80μ. Fifth abdominal tergite bearing 6–14 hairs between the siphunculi. Third antennal segment 0·65–1·3 mm long, 2·0–2·7 times as long as the second segment of the hind tarsi, which are 450–520μ long; 2·7–3·3 times as long as the fourth rostral segment, and 17–26 times as long as the longest hair, 40–65μ, borne on the third antennal segment. Processus terminalis bearing 7–11 subapical setae.

Fourth rostral segment, 300–370μ long and bearing 10–17 accessory hairs. Fifth antennal segment 460–580μ long, 1·8–2·3 times as long as the sixth antennal segment. Base of the sixth antennal segment 0·5–0·7 times as long as the fourth rostral segment and bearing 20–20 accessory hairs. Hind tarsus 1, 2·3–3·6 times as long as its basal diameter. Scleroites absent or very small. On *Picea* sp. . . . . **piceae** (p. 150)

– Body length 2·0–7·5 mm, but if more than 4·3 mm, then the longest hair on the third abdominal tergite is 80–320μ long and if only 80–120μ (*laricis*), then the dorsal abdominal hairs usually arise from conspicuous scleroites and the third antennal segment is 500–750μ long, but only 1·3–1·9 times as long as the second segment of the hind tarsus and 7–12 times as long as the longest hair, 50–80μ, borne on the third antennal segment. Fifth abdominal tergite bearing fewer than 8 or more than 15 hairs between the siphunculi. Processus terminalis usually bearing only 3 or 4 subapical setae but if with 6 or 7, then body 2·8–4·4 mm long, fifth antennal segment 280–360μ long, hind tibiae 2·0–3·3 mm long and 30–40 times as long as the longest hair, 75–95μ, borne on it (*escherichi*) or 14–17 times as long as the longest hair, 140–160μ, borne on it (*brauni*) 3

3 (2) Fifth abdominal tergite bearing 4–7 hairs between the siphunculi. Third antennal segment 400–700μ long, 1·8–2·6 times as long as the second segment of the hind tarsus, 220–350μ; and 5·5–12 times as long as the longest hair, 50–100μ, borne on it. Scleroites absent. Body length 2·2–4·0 mm. On *Pinus* 4

– Fifth abdominal tergite bearing 16–70 hairs between the siphunculi. Third antennal segment 0·8–2·2 times as long as the second segment of the hind tarsus, if more than 1·7 times then either the dorsal abdominal hairs arise from evident scleroites (*laricis* and *schimitscheki*) or the longest hairs on the third antennal segment are 140–320μ long (*bogdanowi* and *abieticola*) . . 6

4 (3) Fourth rostral segment 140–180μ long, fifth rostral segment 70–95μ long. Body length 2·2–4·0 mm. Hind tibiae 1·8–2·9 mm long, 14–25 times as long as the longest hair, 75–140μ, borne on them. Third antennal segment 5·5–9·0 times as long as the longest hair borne on it. Longest hair on 3rd abdominal tergite 15–75μ, on 8th abdominal tergite 90–150μ. Second antennal segment bearing 6–9 hairs, base of sixth antennal segment bearing 8–14 hairs. Fourth rostral segment bearing 6–10 hairs, subgenital plate bearing 20–42 hairs. Eighth abdominal tergite bearing 9–19 hairs. On *Pinus sylvestris* . . . . **pini** (p. 160)

– Fourth rostral segment 200–240μ long, fifth rostral segment 95–140μ long . 5

5 (4) Processus terminalis bearing 4 subapical setae. Second segment of hind tarsus 250–310μ long, 1·1–1·4 times as long as the fourth rostral segment, which is 1·6–1·8 times as long as the fifth rostral segment, 120–140μ, 1·7–2·1 times as long as the first segment of the hind tarsus, and bears 6–8 accessory hairs. Ultimate rostral segment (segments 4+5) 1·1–1·4 times as long as the second segment of the hind tarsus. Third antennal segment 2·6–3·0 times as long as the fourth rostral segment, 6–8·5 times as long as the longest borne on it and bearing 1–6, usually 3–5 rhinaria. Hind tibia 2·5–3·2 mm long, 20–29 times as long as the longest hair, 110–130μ, borne on it. Longest hair on the third abdominal tergite 65–100μ, on the 8th tergite 120–160μ. Second antennal segment bearing 6–8 hairs, base of the sixth antennal segment bearing 9–13 hairs, subgenital plate bearing 24–38 hairs, and eighth abdominal tergite bearing 10–17 hairs. On *Pinus nigra* . ***acutirostris*** (p. 128)

– Processus terminalis bearing 6 or 7 subapical setae. Second segment of hind tarsus 300–360μ long, 1·4–1·7 times as long as the fourth rostral segment, which is 2·0–2·2 times as long as the fifth rostral segment, 95–110μ, 1·3–1·6 times as long as the first segment of the hind tarsus and bearing 8–11 accessory hairs. Ultimate rostral segment (segments 4+5) 0·9–1·1 times as long as the second segment of the hind tarsus. Third antennal segment 3·0–3·3 times as long as the fourth rostral segment, 8·5–11·5 times as long as the longest hair borne on it and bearing 4–10, usually 5–7, rhinaria. Hind tibia 2·9–3·2 mm long, 32–38 times as long as the longest hair, 75–95μ, borne on it. Longest hairs on the third abdominal tergite 30–55μ, on the eighth tergite 120–160μ. Second antennal segment bearing 7–13 hairs, base of sixth antennal segment bearing 12–16 hairs, subgenital plate bearing 39–58 hairs, eighth abdominal tergite bearing 17–22 hairs. On *Pinus sylvestris*. ***escherichi*** (p. 139)

6 (3) Base of the sixth antennal segment 250–320μ long and bearing 10–14 hairs. Hind tibiae 4·3–6·7 mm long and 14–24 times as long as the longest hair, 220–280μ, borne on them. Large aphid, body length 5·0–7·5 mm. Third antennal segment 0·8–1·2 mm long, 2·9–4·5 times as long as the longest hair, 220–320μ, borne on it. Longest hair on third abdominal tergite 160–320μ, on eighth abdominal tergite 250–320μ. Primary rhinaria without chitinized rims. Fourth rostral segment 290–370μ long and bearing 8–13 accessory hairs. Second segment of hind tarsus 420–570μ long, 2·6–3·5 times as long as the first tarsal segment which is 140–200μ long and 2·2–2·9 times as long as its own basal width. Second antennal segment bearing 18–25 hairs. Third antennal segment bearing 7–15, usually 8 or 9, rhinaria. Fourth antennal segment bearing 2–5, usually 3 or 4, rhinaria. Scleroites very small. On *Abies* and *Cedrus* . . . . ***abieticola*** (p. 123)

– Base of the sixth antennal segment 100–240μ long. Hind tibia 1·3–4·1 mm long. Body length 2·0–5·3 mm, but if more than 4·5 mm, then primary rhinaria with a chitinized rim, longest hair on the third antennal segment less than 200μ long and on eighth abdominal tergite less than 250μ long. If the body is more than 4·5 mm long then either it is 2·0–2·3 times as long as the hind tibiae, 1·9–2·2 mm (*pectinatae*), or the hind tibiae are 2·2–3·2 mm long (*laricis* and *pinea*) and bear hairs only up to 120–150μ long (*laricis*) or the first tarsal segment is 210–330μ long and 4·3–5·7 times as long as its own basal width (*pinea*) or the hind tibiae are 2·4–3·5 mm long and the second tarsal segment 310–420μ long and 2·2–2·7 times as long as the first tarsal segment (*bogdanowi*) 7

7 (6) Rostral segments 4+5 together 1·3–1·5 times as long as the second segment of the hind tarsus, which is 0·9–1·2 times as long as the fourth rostral segment alone. Fourth rostral segment 300–370μ long and bearing 6 or 7 accessory

hairs. Second segment of hind tarsus 1·7–2·0 times as long as the first segment of the hind tarsus, 160–200μ. Second antennal segment bearing 7–13 hairs, base of the sixth antennal segment bearing 6–9 hairs, processus terminalis with 4 subapical setae and sub-genital plate bearing 50–70 hairs. Fifth abdominal tergite bearing 45–80 hairs between the siphunculi, eighth abdominal tergite bearing 27–60 hairs. Dorsal abdominal hairs arising from small dark scleroites 12–20μ in diameter, about twice the diameter of the hair bases. Third antennal segment 1·8–2·1 times as long as the second segment of the hind tarsus without or bearing only one rhinarium. Longest hair on eighth abdominal tergite 110–150μ long, 0·8–1·2 times as long as the longest hair, 120–150μ on the third antennal segment. Longest hair on the hind tibiae 150–170μ and on the third abdominal segment 70–110μ. Fifth antennal segment 1·2–1·5 times as long as the sixth segment and 0·4–0·6 as long as the fourth rostral segment which is 1·4–2·0 times as long as the first segment of the hind tarsus. On *Pinus nigra* . . . ***schimitscheki*** (p. 164)

– Rostral segments 4+5 together 0·5–1·3 times as long as the second segment of the hind tarsus which is rarely less than 1·3 times as long as the fourth rostral segment alone. Fourth rostral segment 130–310μ long but if more than 260μ then the longest hair on the third abdominal tergite is 120–240μ long and *either* the fourth rostral segment bears 8–15 accessory hairs, the longest hairs on the third antennal segment are 140–190μ, on the eighth abdominal tergite are 150–220μ, scleroites are absent, the second antennal segments bear 14–24 hairs, the base of the sixth antennal segment bears 11–19 hairs, the subgenital plate bears 22–40 hairs and the second segment of the hind tarsus is 2·2–2·7 times as long as the first segment of the hind tarsus, *or* if the fourth rostral segment bears 4–7 accessory hairs, then the third antennal segment is 1·2–1·7 times as long as the second segment of the hind tarsus, the longest hair on the eighth abdominal tergite is 1·2–1·9 times as long as the longest hair on the third antennal segment, the longest hairs on the hind tibiae are 190–270μ long and the longest of 17–27 hairs on the eighth abdominal tergite are 170–250μ long, the sixth antennal segment is 0·65–1·0 times as long as the first segment of the hind tarsus, which is 210–330μ long and the dorsal abdominal hairs arise from large scleroites (*pinea*), *or* the processus terminalis bears 6 or 7 hairs, the base of the sixth antennal segment bears 11–14 hairs, the fifth abdominal tergite bears 16–26 hairs between the siphunculi, the eighth abdominal tergite bears 11–16 hairs, the third antennal segment bears hairs up to 80–110μ long and usually 2–4 rhinaria (*brauni*) . 8

8 (7) A short-haired aphid. Third antennal segment 550–750μ long and 17–25 times as long as the longest hair, 20–45μ, borne on it. Hind tibia 2·6–3·2 mm long, 35–70 times as long as the longest hair, 50–80μ, borne on it. Longest hair on the 3rd abdominal tergite only 20–40μ long, on the eighth abdominal tergite 70–100μ. Fifth abdominal tergite bearing 16–25 hairs between the siphunculi. Second segment of hind tarsus 440–570μ long, 2·4–2·8 times as long as the fourth rostral segment, and 1·0–1·8 times as long as the diameter of the siphuncular cone.

Processus terminalis 12–20% of the total length of the sixth antennal segment. Base of the sixth antennal segment 150–190μ long, 0·9–1·2 times as long as the fourth rostral segment and bearing 7–9 hairs. Fourth rostral segment bearing 4–8 accessory hairs. Dorsal abdominal hairs arising from small scleroites at the hair bases. On *Larix* . . . . ***boerneri*** (p. 129)

– Longer-haired aphids. Third antennal segment 300–900μ long and 1·5–12 times as long as the longest hair, 50–250μ, borne on it. Hind tibia 1·4–3·5 mm long, 5·5–23 times as long as the longest hair, 95–350μ, borne on it. Longest hairs on the third abdominal tergite 70–230μ long, on the eighth

abdominal tergite 100–260μ long, if less than 130μ the fifth abdominal tergite usually bearing 24–54 hairs between the siphunculi. Second segment of the hind tarsus less than 2·4 times as long as the fourth rostral segment or, if longer, then the body and appendages usually bear long fine hairs, those on the antennae being 85–230μ, on the hind tibiae 180–350μ, on the third abdominal tergite 100–230μ and on the eighth abdominal tergite 120–260μ 9

9 (8) Dorsal abdominal hairs arising from conspicuous dark scleroites (Text-fig. 32), 45–120μ in diameter, the larger scleroites being 3–6 times the diameter of the hair bases borne on them. Third antennal segment is 2·2–3·0 times as long as the fourth rostral segment. Longest hair on third antennal segment 120–170μ, on third abdominal tergite 150–240μ long. The fifth rostral segment is 210–330μ long. Fifth antennal segment 1·1–1·7 times as long as the sixth antennal segment. Base of the sixth antennal segment 150–230μ, 0·65–0·95 times as long as the fourth rostral segment. Hind tibiae 2·2–3·2 mm long, 9–16 times as long as the longest hair, 190–270μ, borne on them.

Body length 3·2–5·3 mm. Third antennal segment 500–800μ long, 3·5–6·0 times as long as the longest hair borne on it and 1·2–1·7 times as long as the second segment of the hind tarsus. Processus terminalis 40–85μ long and bearing 4 sub-apical setae. Fourth rostral segment 210–270μ long, bearing 4–6 accessory hairs and 1·6–2·1 times as long as the fifth rostral segment. Second segment of hind tarsus 1·4–2·0 times as long as the first segment of the hind tarsus which is 4·3–5·7 times as long as its basal width. On *Pinus sylvestris* . . . . **pinea** (p. 156)

– Dorsal abdominal scleroites small or absent or, if large and conspicuous, then the third antennal segment is 3·0–4·3 times as long as the fourth rostral segment, the longest hair borne on the third antennal segment is 50–120μ long, and on the third abdominal tergite is 70–150μ long and the fifth rostral segment is 85–110μ long; and *either* the third antennal segment is 7–12 times as long as the longest hair borne on the third segment, the hind tibia is 2·2–3·0 mm long, 16–23 times as long as the longest hair borne on it, the base of the sixth antennal segment is 100–160μ long, the processus terminalis is 25–45μ long, the fourth rostral segment is 160–200μ long and the fifth rostral segment is 85–110μ long (*laricis*), *or* the first segment of the hind tarsus is 130–180μ long and 2·6–4·0 times as long as its own basal diameter, the longest hair on the hind tibia is 120–150μ, the third antennal segment is 300–550μ long and 1·8–2·1 times as long as the second segment of the hind tarsus and 1·6–2·3 times as long as the fourth rostral segment, which is 2·1–2·8 times as long as the fifth rostral segment; the fifth antennal segment is 0·8–1·1 times as long as the sixth antennal segment, the base of the sixth antennal segment is 160–200μ long and 0·45–0·6 times as long as the fourth rostral segment, whish is 190–250μ long and bears 7–8 accessory hairs (*pectinatae*) . . . 10

10 (9) Processus terminalis bearing 6 or 7 sub-apical setae. Fourth rostral segment 260–300μ long and bearing 4–7 accessory hairs. Second antennal segment bearing 8–12 hairs. Fifth abdominal tergite bearing 16–20 hairs between the siphunculi, eighth abdominal tergite bearing 12–16 hairs.

Third antennal segment 1·3–1·7 times as long as the second segment of the hind tarsus, 6·5–8·0 times as long as the longest hair, 80–110μ, borne on it and bearing 9–13 rhinaria. Longest hair on the eighth abdominal tergite 130–200μ, 1·5–1·9 times as long as the longest hair on the third antennal segment. Fifth antennal segment 1·0–1·2 times as long as the sixth antennal segment. First tarsal segment 4–5 times as long as its basal diameter. Scleroites absent. Body 2·8–3·7 mm long. Hind tibiae 2·1–2·5 mm long, 14–17 times as long as the longest hair, 140–160μ, borne on them. On *Pinus nigra* . . . . **brauni** (p. 133)

– Processus terminalis bearing 3 or 4, or exceptionally 2 or 5 sub-apical setae. Fourth rostral segment usually only 130–240μ long but if 240–290μ long, then bearing 8–15 accessory hairs and the second antennal segment bears 14–26 hairs, the fifth abdominal tergite bears 30–55 hairs between the siphunculi and the eighth abdominal tergite bears 24–42 hairs (*bogdanowi*) . 11

11 (10) Fourth rostral segment 230–300μ long and bearing 8–15 accessory hairs. Third antennal segment 500–900μ long, and 1·7–2·2 times as long as the second segment of the hind tarsus, which is 2·2–2·7 times as long as the first segment of the hind tarsus. Fourth antennal segment 240–440μ long, 1·1–1·7 times as long as the sixth antennal segment, fifth antennal segment 300–480μ long and 1·5–1·9 times as long as the sixth antennal segment.

Body 3·2–5·0 mm long. Siphuncular cone 500–700μ in diameter. Hind tibiae 2·4–3·5 mm long. Processus terminalis bearing 4 subapical setae. On *Picea* . . . . **_bogdanowi_** (p. 132)

– Fourth rostral segment 130–250μ long and bearing 2–8 accessory hairs. If fourth rostral segment more than 210μ long, then the third antennal segment is 300–660μ long, 0·8–1·6 times as long as the second segment of the hind tarsus which is 2·8–4·4 times as long as the first segment of the hind tarsus, the fourth antennal segment is 120–240μ long and 0·7–1·2 times as long as the sixth antennal segment, the fifth antennal segment is 160–280μ long and 0·8–1·4 times as long as the sixth antennal segment 12

12 (11) Third antennal segment 500–750μ long, 7·5–12·0 times as long as the longest hair, 50–80μ, borne on it. Dorsal abdominal hairs usually arising from dark scleroites, the largest of which have a diameter several times that of the bases of the hairs borne on them. Fifth antennal segment 1·7–2·7 times as long as the sixth antennal segment. Longest hair on the third abdominal tergite 70–110μ long. Third antennal segment 1·3–1·9 times as long as the second segment of the hind tarsus, which is 2·1–2·7 times as long as the first segment of the hind tarsus.

Body length 3·1–4·8 mm. Hind tibiae 2·2–3·0 mm long, 16–23 times as long as the longest hair, 120–150μ, borne on them. Longest hair on the eighth abdominal tergite 1·7–3·0 times as long as the longest hair on the third antennal segment. On *Larix* . . . . **_laricis_** (p. 146)

– Third antennal segment 1·5–7·0 times as long as the longest hair borne on it. Dorsal abdominal hairs without or with only very small scleroites at their bases, or if the scleroites are more than twice the diameter of the hair bases (*pectinatae*) then the fifth antennal segment is 0·8–1·1 times as long as the sixth antennal segment and the second segment of the hind tarsus is 1·7–2·1 times as long as the first segment of the hind tarsus. Fifth antennal segment usually 0·7–1·4 times as long as the sixth segment, if 1·5–2·0 times as long (*pinihabitans*) the longest hair on the third abdominal tergite is 120–180μ long, on the third antennal segment is 120–160μ long, and the third antennal segment is 2·0–2·5 times as long as the second segment of the hind tarsus. Hind tibia 5·5–16 (exceptionally—18) times as long as the longest hair borne on it. Longest hair on the eighth abdominal tergite 0·8–2·0 times as long as the longest hair on the third antennal segment, except in *pectinatae* . . 13

13 (12) Many dorsal abdominal hairs arising from scleroites, the largest of which have a diameter three times that of the hair bases. Dorsal length of first segment of hind tarsus 150–180μ, ventral length 190–270μ and 3·9–5·6 times as long as its proximal diameter. Body 3·2–5·0 mm long and 2·0–2·3 times as long as the hind tibiae, which are 1·4–2·2 mm long. Longest hairs on the eighth abdominal tergite 170–210μ long and 1·6–2·8 times as long as the longest hairs on the third antennal segment, which are 75–120μ long. Fourth rostral segment 190–250μ long, 2·1–2·8 times as long as the fifth rostral

segment and 0·8–1·1 times as long as the first segment of the hind tarsus. Fifth antennal segment 0·8–1·1 times as long as the sixth. Second antennal segment bearing 6–8 hairs, base of the sixth antennal segment bearing 5–7 hairs. Green aphid on *Abies* . . . . ***pectinatae*** (p. 148)

— Dorsal abdominal scleroites absent or, if present, not exceeding twice the diameter of the hair bases. First segment of hind tarsus 15–80μ long dorsally, 80–160μ long ventrally, and 2·1–3·6 (exceptionally 4·0) times as long as its proximal diameter. Body 2·0–4·5 mm long, 1·2–2·2 times as long as the hind tibiae, only exceeding 2·0 in *pilicornis*. Longest hair on the eighth abdominal tergite 100–260μ long, 1·0–1·7 (rarely 2·0) times as long as the longest hair, 70–250μ, on the third antennal segment. Fourth rostral segment 1·5–2·2 times as long as the fifth rostral segment and usually 1·2–2·4 as long as the first segment of the hind tarsus. If fourth rostral segment 1·0–1·3 times as long as the first segment of the hind tarsus (*pinihabitans*), then fifth antennal segment 1·5–2·0 times as long as the sixth antennal segment. Second antennal segment bearing 5–20 hairs, base of the sixth antennal segment bearing 5–20 hairs. Brown, reddish or yellowish aphids on *Pinus*, *Picea* and Cupressaceae 14

14 (13) Third antennal segment 550–750μ long, 3·8–5·2 times as long as the fourth rostral segment which is 130–170μ long, bears 4 accessory hairs and is 1·0–1·3 times as long as the first segment of the hind tarsi. Third antennal segment 2·0–7·5 times as long as the second segment of the hind tarsus, which is 260–340μ long and 2·0–2·3 times as long as the first segment of the hind tarsus. Fifth antennal segment 240–380μ long and 1·5–2·0 times as long as the sixth antennal segment, which is 120–160μ long. Base of the sixth antennal segment bearing 7–11 hairs. Second antennal segment bearing 6–8 hairs.

Processus terminalis bearing 4 subapical setae. Eighth abdominal tergite bearing 11–22 hairs. On *Pinus sylvestris* . . ***pinihabitans*** (p. 162)

— Third antennal segment 300–600μ long, 1·8–3·6 times as long as the fourth rostral segment, which is 130–250μ long and is 1·2–2·2 times as long as the first segment of the hind tarsus. Third antennal segment 0·9–1·6 times as long as the second segment of the hind tarsus, which is 240–540μ long and 2·6–4·4 times as long as the first segment of the hind tarsus. Fifth antennal segment 160–300μ long and 0·7–1·4 times as long as the sixth antennal segment, which is 110–240μ long. Base of the sixth antennal segment bearing 5–20 hairs. Second antennal segment bearing 7–20 hairs. On *Picea* and Cupressaceae 15

15 (14) Membrane of the fore wing characteristically pigmented (Text-fig. 20), media once branched. Second segment of the hind tarsus 300–380μ long, 1·3–1·7 times as long as the fourth rostral segment which is 190–250μ long. Primary rhinaria with a chitinized rim. Third antennal segment 2·0–3·5 times as long as the longest hair, 150–210μ, borne on it, and 1·3–1·6 times as long as the second segment of the hind tarsus, which is 0·5–1·0 times as long as the siphuncular diameter. Hind tibia 2·0–2·6 mm long and 7·5–10 times as long as the longest hair, 190–300μ, borne on it. Third antennal segment bearing only 1–3 rhinaria. Base of the sixth antennal segment bearing 12–20 hairs. Processus terminalis bearing 3 or 4 sub-apical setae. Processus terminalis only 6–18% of the total length of the sixth antennal segment. On *Picea*. ***costata*** (p. 134)

— Wing membrane uniformly transparent, media usually twice branched (Text-fig. 37). Second segment of the hind tarsus 1·6–2·7 times as long as the fourth rostral segment, if less than 1·8 then either the primary rhinaria without a chitinized rim (subgen. *Cupressobium*) or the longest hair on the

hind tibia only 95–180μ long (*stroyani*). Primary rhinaria with or without a chitinized rim but if with, then the third antennal segment is 3·0–3·7 times as long as the longest hair, 70–160μ, borne on it and 0·9–1·3 times as long as the second segment of the hind tarsus and the base of the sixth antennal segment bears 6–17 but mostly 9–12 hairs. Processus terminalis 14–29% of the total length of the sixth antennal segment except in *tujafilina* (8–15%), in which the fourth rostral segment is only 130–180μ long. 16

16 (15) Longest hair on the third abdominal tergite 55–110μ long. Hind tibiae 9·5–17 times as long as the longest hair, 140–180μ, borne on the hind tibiae. Third antennal segment 3·5–7·0 times as long as the longest hair, 70–110μ, borne on it. Base of the sixth antennal segment bearing 9–17 hairs and 0·6–0·8 times as long as the fourth rostral segment.

Processus terminalis bearing 4 sub-apical setae. On *Picea* ***stroyani*** (p. 165)

– Longest hair on the third abdominal tergite 105–240μ long. Hind tibiae 5·5–11 but rarely more than 9·5 times as long as the longest hair, 140–360μ, borne on the hind tibia. If the longest hind tibial hair is less than 180μ long (*tujafilina*), then the fourth rostral segment 130–180μ long and the third antennal segment is 2·0–2·9 times as long as the longest hair, 120–200μ, borne on it, the longest hair on the third abdominal tergite is 120–210μ long and the base of the sixth antennal segment is 0·9–1·3 times as long as the fourth rostral segment. Third antennal segment 1·5–5·0 times as long as the longest hair which is rarely 80–110μ, but usually 110–250μ long . . 17

17 (16) Processus terminalis bearing 4 sub-apical setae. Primary rhinaria with a chitinized rim. Third antennal segment 3·0–3·5 times as long as the longest hair, 80–160μ, borne on it. Base of sixth antennal segment 0·6–0·9 times as long as the fourth rostral segment which is 160–250, rarely less than 190μ, long. Longest hair on hind tibia 160–240μ. Second segment of hind tarsus 350–420μ and 1·1–2·3 times as long as the diameter of the siphuncular cone. On *Picea* . . . . ***pilicornis*** (p. 152)

– Processus terminalis bearing only 3 sub-apical setae. Primary rhinaria without a chitinized rim. Third antennal segment 1·8–2·9 times as long as the longest hair on it. Base of the sixth antennal segment 0·9–1·7 times as long as the fourth rostral segment, which is 130–210μ long, but if more than 180μ long, then the longest hair on the third antennal segment is 190–250μ long. Longest hair on hind tibia 140–350μ, if less than 230μ (*tujafilina*), then the second segment of the hind tarsus is only 240–340μ long. On Cupressaceae (subgen. *Cupressobium*) 18

18 (17) Base of the sixth antennal segment bearing only 5 or 6 hairs. Fourth rostral segment 130–170μ long and bearing 2–4 accessory hairs. Third antennal segment bearing 1–6 rhinaria, usually confined to the distal half of the segment.

Fifth antennal segment 180–240μ long. Processus terminalis 30–50μ long, 15–23% of the total length of the sixth antennal segment. On *Cupressus*, *Juniperus* and *Thuja* . . . . ***cupressi*** (p. 136)

– Base of the sixth antennal segment bearing 6–14 but rarely less than 8 hairs. Fourth rostral segment 130–210μ long and bearing 4–8 accessory hairs. Third antennal segment bearing 3–11 rhinaria, usually extending onto the proximal half of the segment 19

19 (18) Tibiae pale to dusky, rarely dark brown, except for the distal apex which is dark. Processus terminalis 10–30μ long, 8–16% of the total length of the sixth antennal segment. Third antennal segment (Text-fig. 38) 300–450μ long, 1·0–1·9 but rarely less than 1·3 times as long as the diameter of the siphuncular cone. Fifth antennal segment 160–200μ long. Longest hair on eighth abdominal tergite 130–210μ long. Second segment of hind tarsus

(Text-fig. 39) 240–330μ long, 0·7–1·4, usually 1·0–1·3 times as long as the diameter of the siphuncular cone (Text-figs 40 & 41). On *Callitris* and *Thuja* . . . . ***tujafilina*** (p. 166)

– Tibiae black or black at base and apex and dark brown in the middle. Processus terminalis 35–80μ long, 14–29% of the total length of the sixth antennal segment. Third antennal segment 350–600μ long, 0·8–1·6 but rarely more than 1·3 times as long as the diameter of the siphuncular cone. Fifth antennal segment 180–300μ, rarely less than 200μ long. Longest hair on eighth abdominal tergite 190–260μ, rarely less than 210μ long. Second segment of hind tarsus 280–400μ long, 0·6–1·2, usually 0·7–1·0 times as long as the diameter of the siphuncular cone. On *Cupressus* and *Juniperus* . 20

20 (19) Second segment of hind tarsus 1·6–2·1, usually 1·7–2·0 times as long as the fourth rostral segment, which bears 5–8 accessory hairs. Second antennal segment bearing 10–14 hairs. Fifth abdominal tergite bearing 60 or more hairs between the siphunculi. Third antennal segment 1·2–1·6, rarely less than 1·3 times as long as the second segment of the hind tarsus. Base of the sixth antennal segment 0·8–1·3, usually 1·0–1·3 times as long as the fourth rostral segment. Longest hair on the eighth abdominal tergite 0·9–1·2 times as long as the longest hair on the third antennal segment. Radial sector of fore wing often not reaching wing apex. On *Cupressus* and *Juniperus* . . . . ***fresai*** (p. 140)

– Second segment of hind tarsus 2·0–2·8, usually 2·4–2·6 times as long as the fourth rostral segment, which bears 4 accessory hairs and is 1·4–1·6 times as long as the first segment of the hind tarsus. Second antennal segment bearing 7–11 hairs. Fifth abdominal tergite bearing 25–45 hairs between the siphunculi. Third antennal segment 1·0–1·3 times as long as the second segment of the hind tarsus. Base of the sixth antennal segment 1·1–1·7, usually 1·4–1·6 times as long as the fourth rostral segment. Longest hair on the eighth abdominal tergite 1·2–1·4 times as long as the longest hair on the third antennal segment. Radial sector of fore wing reaching wing-apex. On *Juniperus* . . . . ***juniperi*** (p. 141)

The British Species of *CINARA*

Cinara abieticola (Cholodkovsky)

(Text-figs 1–5)

Aphis borealis Curtis, 1828 : 201. [Types unknown. 'Floating floes of ice in the Polar Sea . . . as far north as 82°.']

Lachnus confinis Koch, 1856 : 245 [No types. Collection data not given, presumably Germany.]

[***Lachnus grossus*** (Kaltenbach) Cholodkovsky, 1896*a* : 145; 1898*a* : 656–657; 1902 : 6; Mordwilko, 1929 : 27; Gillette & Palmer, 1930 : 544, 551. Misidentifications.]

Lachnus abieticola Cholodkovsky, 1899 : 470–471. [Types unknown. Western Siberia: Tomsk, Summer 1898, apterae viviparae (*W. Plotnikov*)]; 1902 : 6.

Lachniella cilicica Del Guercio, 1909 : 287, 297–301. [Types unknown. Italy: Castelfalfi, May, 1893, aptera vivipara (*Biondi*)]; Jackson, 1919 : 164.

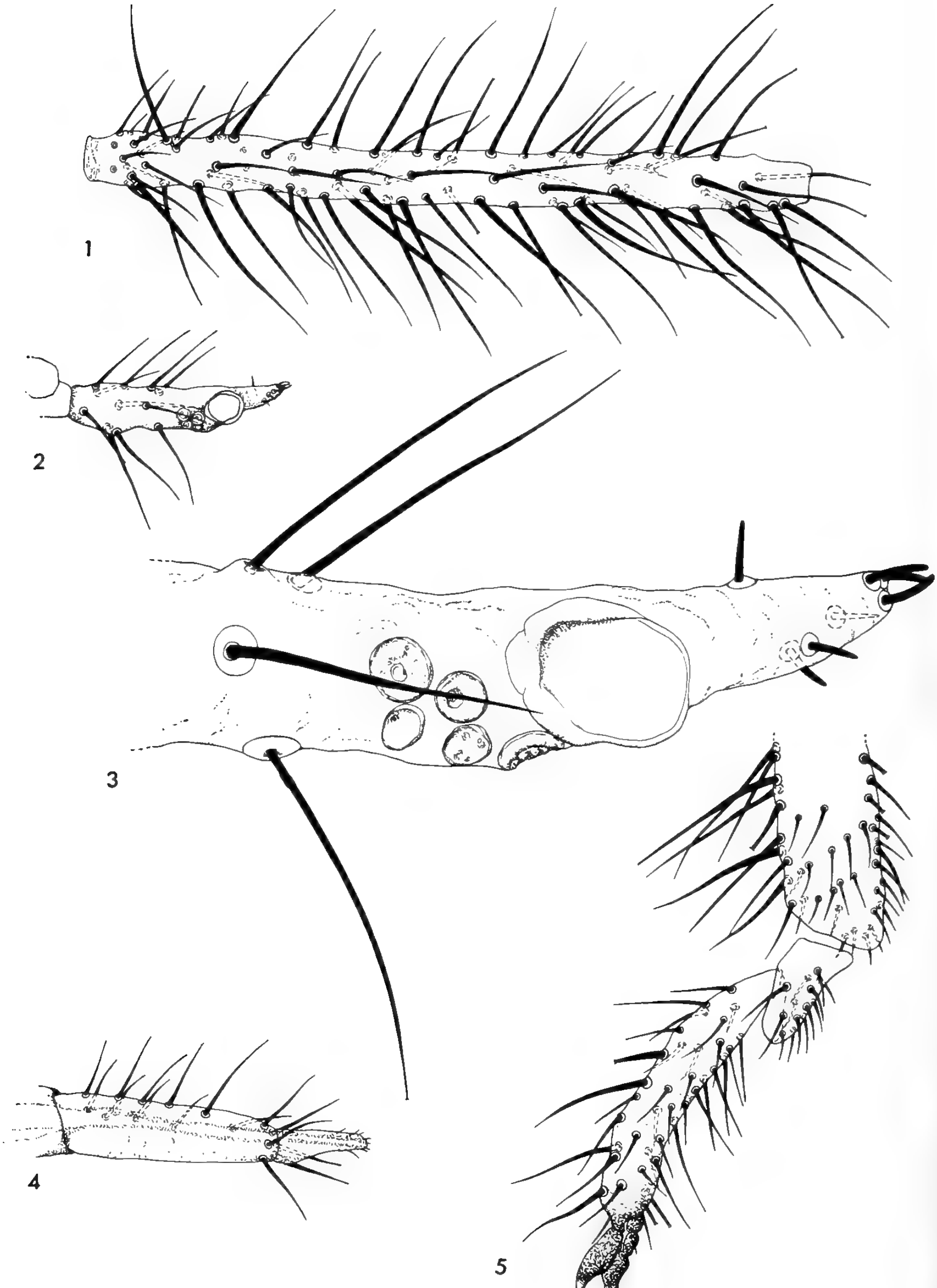
Lachniella cilicica v. ***cecconii*** Del Guercio, 1909 : 297. [As for *cilicica* s. str.]

Lachnus vanduzei Swain, 1919 : 50–51. [Types, University of California. California; spruce, September & November, apterae & alatae viviparae, 1914 (*E. P. Van Duzee & E. O. Essig*).]

[***Dilachnus piceae*** (Walker) Swain, 1921 : 225–227, nec Panzer, 1801.]

Panimerus cilicica (Del Guercio) Theobald, 1929 : 142–145.

Panimerus vanduzei (Swain) Theobald, 1929 : 154–156, partim, the Irish specimens.



Figs 1–5. *Cinara abieticola*, aptera vivipara. 1, third antennal segment, × 87. 2, sixth antennal segment, × 87. 3, processus terminalis, × 450. 4, fourth and fifth rostral segments, × 110. 5, hind tarsus, × 87.

? *Lachnus lasiocarpae* Gillette & Palmer, 1930 : 543–544. [Types, USNM. Catalogue no. 42082. 'Paratypes' at Fort Collins. COLORADO: *Abies lasiocarpa*.]
Dilachnus pubescens Wellenstein, 1930 : 743–747, 752. [Types unknown. Collection data not given, presumably GERMANY: Hann, alate males and oviparae.]
? *Cinara lasiocarpae* (Gillette & Palmer) Gillette & Palmer, 1931 : 858; Palmer, 1952 : 34.
Cinara cecconii (Del Guercio) Braun, 1938 : 478.
[*Cinara grossus* (Kaltenbach) Blanchard, 1939 : 862–864. Misidentification.]
Dinolachnus cecconii (Del Guercio) Börner, 1940 : 1.
Neochmosis cilicica (Del Guercio) Kloet & Hincks, 1945 : 72.
[*Cinara grossa* (Cholodkovsky nec Kaltenbach) Mordwilko, 1948 : 201–202.]
Todolachnus abieticola (Cholodkovsky) Börner, 1952 : 44; Pašek, 1954 : 266–269; Heinze, 1962 : 173; Gomez-Menor, 1962 : 390–393.
Todolachnus confinis (Koch) Börner, 1952 : 44; Heinze, 1962 : 173.
Cinara abieticola (Cholodkovsky) Hottes & Essig, 1954 : 95–97; Szelegiewicz, 1962 : 78–79.
[*Dinolachnus piceae* (Panzer) Aizenberg, 1956 : 139; Pintera, 1966 : 281. Misidentifications.]
Cinaria (*Pitsaria*) *vanduzei* (Swain) Aizenberg, 1956 : 139.
Todolachnus abieticola subsp. *bulgarica* Pintera, 1959 : 71. [Holotype, Academy of Science, Prague. BULGARIA: Rila, *Abies alba bulgarica*, August, 1957, apterae viviparae (*A. Pfeffer*).]
Cinara (*Todolachnus*) *abieticola* (Cholodkovsky) Heikinheimo, 1963 : 185; Çanakçioğlu, 1966 : 140–141.
[*Cinara piceae* (Panzer) Shaposhnikov, 1964 : 522. Misidentification.]
Dinolachnus abieticola (Cholodkovsky) Hille Ris Lambers, 1966 : 124.

MATERIAL EXAMINED.

ENGLAND: London, 'conifer', 15.ix.1948, 1 aptera (*A. Smith*); 'near conifer', 23.vi.1969, 1 apt., 1 alata (*B. J. English*); Southgate, *Cedrus deodora*, 1.vii.1955, 4 al. (*Parks Superintendent*); Surrey, Chertsey, 'near cedar', March 1967, 8 apt. & 1 alatoid nymph (*Public Health Inspector*); Essex, Havering, 'cedar', 12.v.1967, 1 apt., 1 al., 1 alatoid nymph (*Health & Welfare Department*); Worcs., Stourbridge, 'crawling under door', 6.v.1949; 2 apt., 1 immature (*Ministry of Health*); Devon, Germansweek, Beauworthy, 'fir', 4.vi.1948, 1 al. (*E. W. Powell*). IRELAND: Avondale, Rathdrum, *Pinus*, 2.vi.1913, 1 apt., 2 al. (*F. V. Theobald*). SCOTLAND: Moray, Rothes, *Abies pectinata*, 24–27.ix.1917, 1 apt. (*D. J. Jackson*); Elgin, Pitgaveny, *Abies nobilis* + *A. grandis*, 12.vi.1923, 2 apt., 3 al., 4 alatoid nymphs (*A. Stables*); Roxburgh, Craik Forest, *Abies alba*, 6.iii.1964, 1 apt. (*C. I. Carter*); Argyll, Kilmum arboretum, *Abies lasiocarpa*, 9.vii.1965, 1 apt. (*C.I.C.*).

CZECHOSLOVAKIA: Košice-Črmel, *Abies alba*, 3.vi.1948, 2 apt. (*V. Pašek*). DENMARK: Palagaard Forest, *A. alba*, 18.vi.1964 (*C. I. Carter*). FRANCE: Vosges, Retournermer, 7–31.vii.1930, 2 al. (*M. E. Mosely*). GERMANY: Unteres Weldental, *A. alba*, 15.vi.1961, 1 apt. (*H. Heinze*). SPITZBERGEN: W. of N.E. Land, S. of Lee-cap, N. of Wahlenberg Bay, c. 1000 ft, 8.viii.1924, 1 al. (*H. M. Clutterbuck*) (other specimens from this series in the Hope Museum, Oxford). TURKEY: Bolu-Aladag, 1360 m., *Abies bornmuelleri*, 4.vii.1964, 18 apt., 1 alatoid nymph (*H. Çanakçioğlu*). INDIA: Mussourie, 6500 ft, under bark of *Cedrus deodora*, July 1920, 2 al., 2 alatoid nymphs (*S. N. Chatterjee*); Rhotang Pass, 13,800 ft, 4.vi.1955, 3 al. (*A. P. Kapaur*). PAKISTAN: Murree, *Abies pindrow*, 2 adult and 2 immature oviparae, 25.xi.1958 (*M. Ghani*); Murree, in spider's web on fir, 2 alate males, 25.xi.1958 (*M. Ghani*).

U.S.A.: California, Berkeley, spruce, 2.ix.1914, 1 aptera [cotype of *vanduzei*]; on pavement, 3.iii.1961, 2 al. (*O. W. Richards*). CANADA: Labrador, Mealy Mts, 31.viii.1958, 2 oviparae (*British School Boys' Exploration Society*); New Brunswick, Acadia Stn, *Abies balsamea*, 8.vi.1960, 2 apt. (*M. E. MacGillivray*).

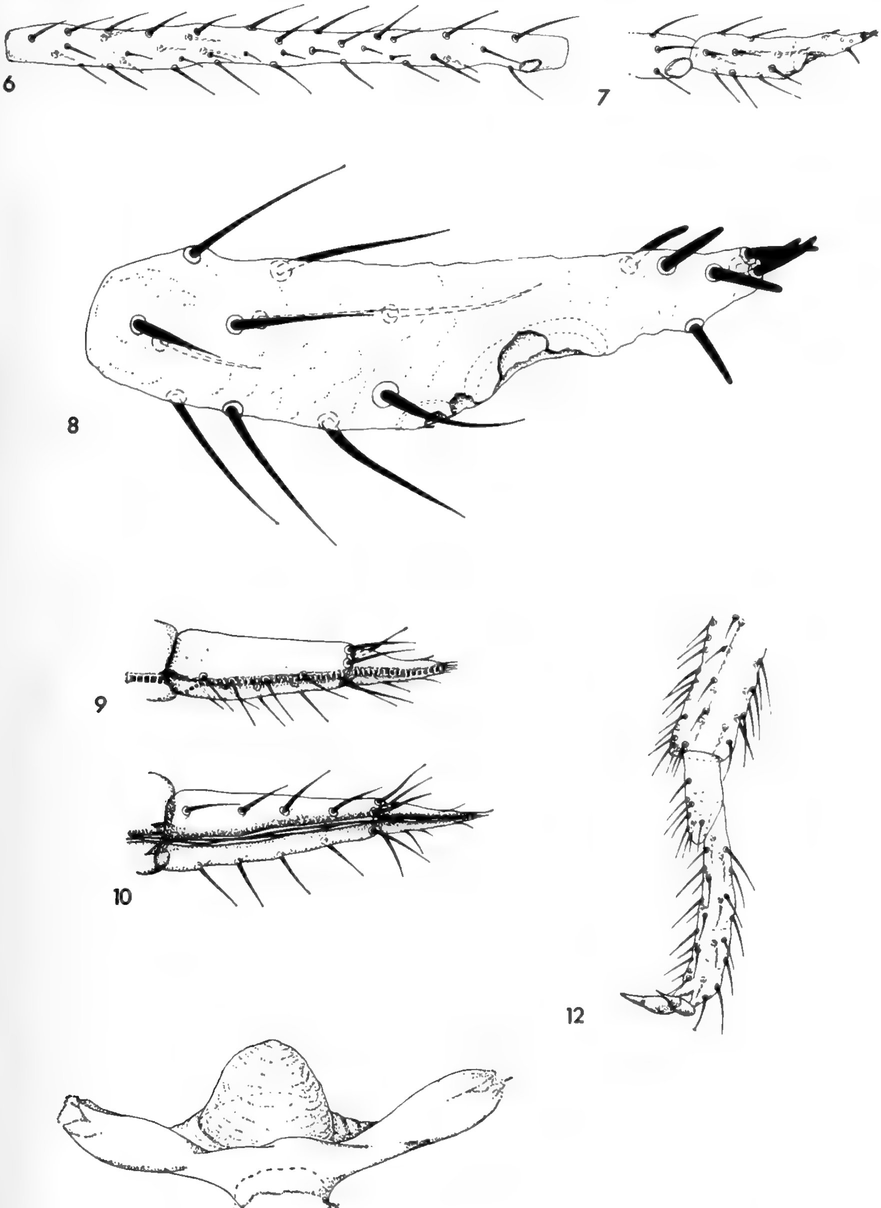
HOST-PLANTS. Specimens have been seen from *Abies alba* (= *pectinata*), *A. balsamea*, *A. bornmuelleriana*, *A. grandis*, *A. lasiocarpa*, *A. nordmanniana*, *A. pindrow* and *Cedrus deodora*. *Cinara abieticola* was described from *Abies sibirica*, (as *Lachnus cilicica*) from *A. cilicica*, and is also recorded from *Abies procera* (= *nobilis*) and *A. religiosa*.

DISTRIBUTION. Specimens have been seen from Czechoslovakia, Denmark, England, France, Germany, Ireland, Scotland, Spitzbergen, Turkey, India, Pakistan, California, Labrador and New Brunswick. *Cinara abieticola* was described from Western Siberia, as *Lachnus cilicica* from Italy, as *bulgarica* from Bulgaria and is also recorded from Austria, Finland, Norway (Stenseth & Bekke, 1968 : 237), Portugal (Ilharco, 1968*a* : 118), Spain, Sweden, Yugoslavia, U.S.S.R., Latvia (Rupais, 1961 : 16–17), Ukraine (Mamontova, 1963 : 21, as *piceae*), Argentina (Blanchard, 1939 : 862–864, as *grossa*) and the Eastern and Western coasts of North America (Hottes, 1960 : 221). Börner (1952 : 44) lists the Italian synonym but says that it is not certain that Italian specimens really belong to the northern European species.

BIOLOGY. Apterae viviparae outnumber alatae viviparae in March and May in Britain but alatae outnumber apterae in June and July. Only apterae viviparae are known for September and *Cinara abieticola* does not seem to have been collected in Britain in August. The summer is said to be spent on the roots of *Abies* in special chambers prepared by ants. Oviparae and alate males have been seen from *Abies pindrow* from Pakistan and were described as *Lachnus pubescens* by Wellenstein (1930 : 743–745) from Europe. Heikinheimo (1963 : 185) has recorded natural enemies.

NOTES. *Cinara abieticola* is a large aphid which sporadically occurs in large numbers between March and June. Heikinheimo has discussed the possibility that *Aphis borealis* Curtis is the earliest name for *abieticola*. Börner (1952 : 44) has identified shorter haired specimens with *Todolachnus confinis* (Koch), presumably because of the long rostrum mentioned in the original description. *Lachnus confinis* was apparently described from a vagrant alata and so was probably fully pigmented. The hind tibiae are figured as being yellow and apart from the length of the rostrum the description fits *pilicornis*. Hottes (1954 : 260) says that *C. lasiocarpae* is very similar to *abieticola* but that it is smaller and has paler legs, bearing shorter and more strongly inclined hairs. Most of the specimens of this group studied have been separable by this combination of characters but intermediates in all characters occur. Larger specimens from Colorado may have rather dark tibiae bearing inclined hairs and the short-haired European forms of *abieticola* have inclined tibial hairs. It seems likely that *Cinara vanduzei*, *C. cecconii*, *C. pubescens*, *C. confinis* (Koch) Börner, *C. lasiocarpae* and *C. abieticola* ssp. *bulgarica* are all forms of *abieticola*. If there really are two or more species, then they are both now probably holarctic

in distribution. *Cinara hattorii* Kono & Inouye, 1938 (= *konoi* Inouye, 1956) and *C. longipennis* (Matsumura, 1917) from *Abies* in Japan are placed in the subgenus



FIGS 6–12. *Cinara acutirostris*, aptera vivipara. 6, third antennal segment, × 87. 7, apex of fifth and sixth antennal segment, × 87. 8, sixth antennal segment, × 450. 9 & 10, fourth and fifth rostral segments with eight accessory hairs, different views, × 110. 11, mesosternal tubercle, × 110. 12, hind tarsus, × 110.

Dinolachnus with *abieticola* by Inouye (1970 : 88–90) and *Cinara sonata* Hottes, 1955, and *C. grande* Hottes, 1956, from *Abies* in North America are also said to be related to *abieticola*.

Aizenberg (1956 : 139) recognized, presumably from the description alone, that *vanduzei* Swain was not *piceae* Panzer (= *grossa*). Aizenberg had apparently not seen Hottes & Essig (1954 : 95–97), in which *vanduzei* is placed as a synonym of *abieticola* and concluded that *vanduzei* was related to *Cinara bogdanowi*. *Pitsaria* is presumably a lapsus for *Pityaria*.

Type-species of *Dinolachnus* Börner, 1940, as *Lachniella cilicica* var. *cecconii* Del Guercio.

Cinara acutirostris Hille Ris Lambers

(Text-figs 6–13)

[*Cinara montanicola* Börner; Stroyan, 1955 : 332–333. Misidentification.]
Cinara acutirostris Hille Ris Lambers, 1956 : 246–249. [Types colln. D. Hille Ris Lambers, described from NETHERLANDS, CZECHOSLOVAKIA, ITALY, ENGLAND]; Stroyan, 1957 : 355; Pintera, 1966 : 309.
Cinaria acutirostris (Hille Ris Lambers) Heinze, 1962 : 166.

MATERIAL EXAMINED.

ENGLAND: Cambridge, Botanical Gardens, *Pinus nigra* var. *calabrica*, 20. iii.1951, first instar larvae of fundatrices and egg-breakers; 25.vi.1951, 12 apterae and 2 alatae viviparae; 2.vii.1951, 4 apt., 8 al.; 13.x.1950, 4 oviparae, 1 apterous male (*V.F.E.*); 9.x.1950, 18 oviparae, 1 apterous male (*H. L. G. Stroyan* coll. & colln.), except for 6 oviparae in BMNH; Kent, Wye, 40′ trap, 3.vii.1969, 1 al. (*N. R. Maslen*), Forestry Commission Colln.

FRANCE: Beauregard, *Pinus nigra*, 11.v.1966, 2 fundatrices (*Laurent* coll.), D. Hille Ris Lambers colln. ITALY: Calabria, Sila, *Pinus calabrica*, August 1968, 2 apterae (*Tremblay* coll.), D.H.R.L. colln.

13

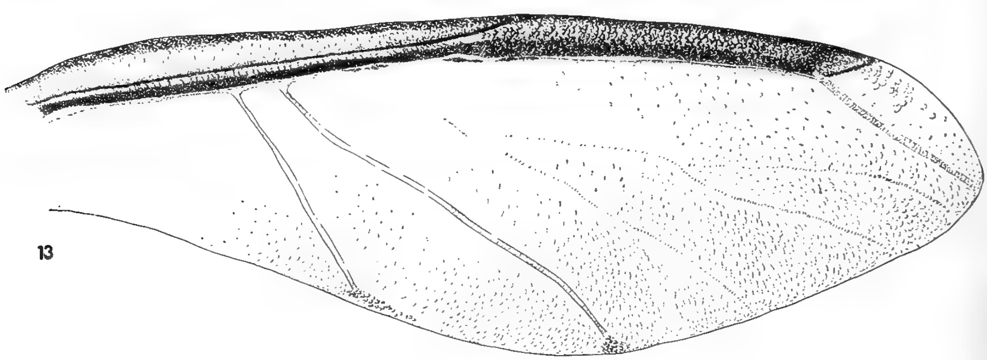


FIG. 13. *Cinara acutirostris*. Fore wing, × 30.

HOST-PLANTS. Seen from *Pinus nigra* var. *maritima* (= *calabrica*), originally described from *P. nigra* (= *austriaca*) and also recorded (Ilharco, 1968*b* : 248) from *Pinus pinea*.

DISTRIBUTION. Specimens have been seen from England, France and Italy, were originally described from the Netherlands and are also recorded from Bulgaria, Czechoslovakia and Portugal.

BIOLOGY. Eggs hatch in the second half ot March at Cambridge. Alatae viviparae are produced in the second half of June and the first week in July. Oviparae and apterous males were collected in October. *Cinara acutirostris* has not been seen from Britain in August or September. When present it may occur in large numbers and be the prey of various natural enemies. Recorded in the original description from a nest of the sphecoid wasp *Psenulus fuscipennis*. Stroyan (1955 : 332) records *Coccinella quadripuncta* as a predator.

Cinara boerneri Hille Ris Lambers

(Text-figs 14–18)

[*Aphis laricis* Walker, 1848 : 102–103, partim, second variety; 1852 : 957–958, partim.]

? *Lachnus laricis* Koch, 1856 : 241–243. [No types. Locality and year not given, presumably GERMANY]: Cholodkovsky, 1898 : 666, partim, nec Walker, 1848.

[*Lachnus pinicolus* (Kaltenbach) Buckton, 1881 : 52–53, partim. Misidentification.]

? *Lachniella laricis cuneomaculata* Del Guercio, 1909 : 291–293. [Types unknown. ITALY: Pratolino, *Larix europaea*, July, aptera vivipara.]

[*Panimerus laricis* (Walker) Theobald, 1929 : 135–139, partim, the alatae viviparae and alate males. Misidentification.]

[*Cinara taeniata* (Koch) Braun, 1938 : 479, partim. Misidentification.]

Cinara laricicola Börner, 1939 : 75. [Types, Deutsches Entomologisches Institut. GERMANY: Böhmen & Ostmark, *Larix*]; Stroyan, 1955 : 331 (nec *Lachnus laricicolus* Matsumura, 1917).

Cinara (*Cinarella*) *laricicola* Börner, Börner, 1949 : 59 (*Cinarella* Börner, 1949, nec *Cinarella* Hille Ris Lambers, 1948).

Cinara (*Cinarellia*) *laricicola* Börner, Börner, 1952 : 41; Pašek, 1954 : 250–253.

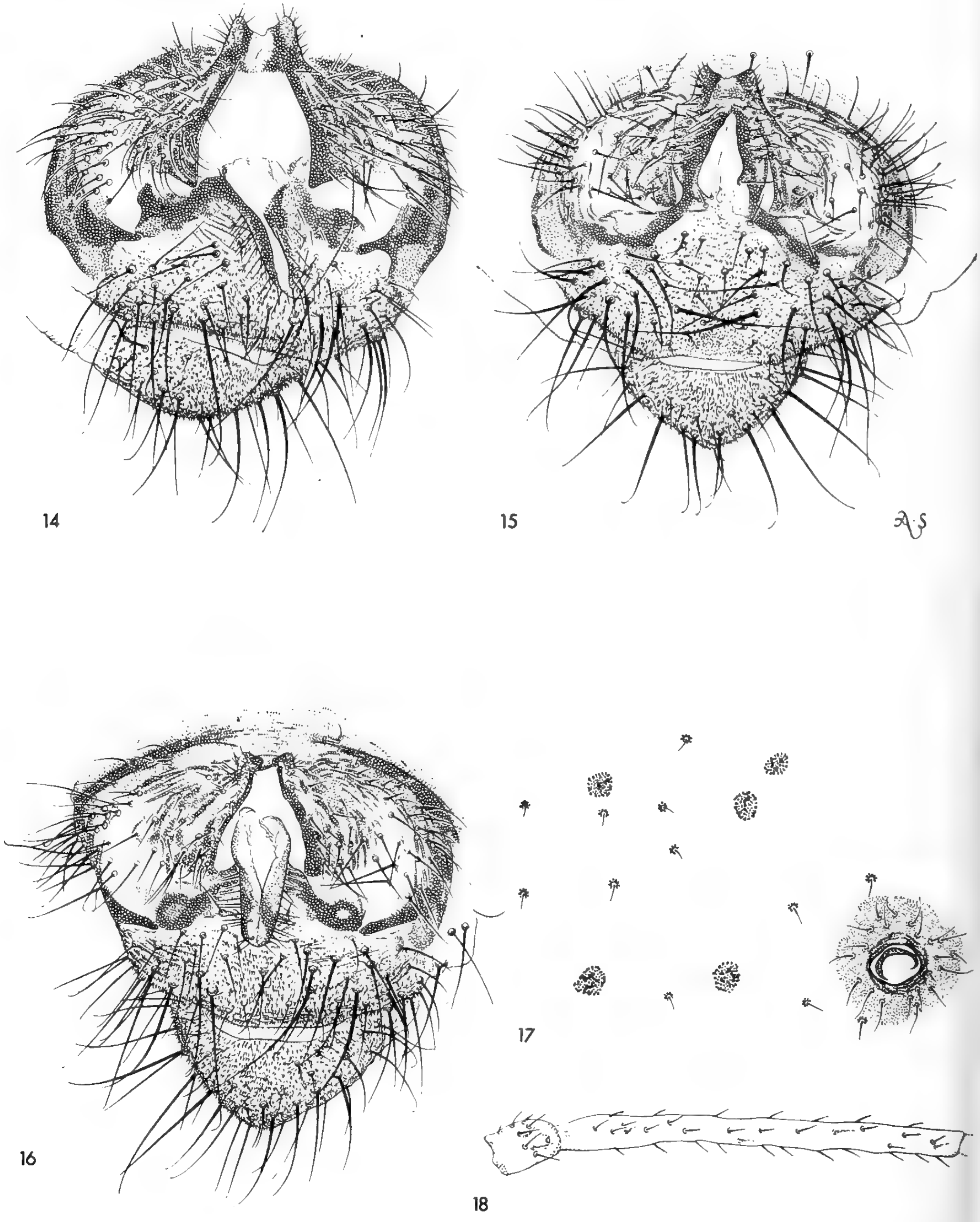
Cinara boerneri Hille Ris Lambers, 1956 : 246. [Nom. n. pro *Cinara laricicola* Börner, 1939, nec Matsumura, 1917]; Stroyan, 1957 : 354–355; Szelegiewicz, 1962 : 80.

Cinara (*Cinarellia*) *boerneri* Hille Ris Lambers, Heinze, 1962 : 154, 156; Pintera, 1966 : 318–319.

MATERIAL EXAMINED.

ENGLAND: Devon, Exeter, *Larix*, 14.ix.1965, 1 aptera (*H. G. Morgan* & colln.); Dorset, Weymouth, Mt Edge, 17.x.1894, 2 alate males (*Bignell*); three other alate males mounted on individual slides in the Buckton collection bear the following data, 'Weymouth, October, Bignell', slide 348; 'Weymouth, larch, September', slide 349; 'Weycombe [Surrey], Sept.', slide 350, and probably belong to the same series as the previous two males. Buckton (1881 : 53) records rearing winged forms, presumably at his home, Weycombe, Surrey, from nymphs collected by Bignell at Weymouth, Dorset. Hants, Alice Holt Lodge, *Larix*, 7.ix.1962, 3 apterae (*C. I. Carter*), Forest Research Station colln. Berks, Tubney, *Larix decidua*, 28.vi.1956, 3 apt., 1 al. (*H. L. G. Stroyan* & colln.). Surrey, Kew Gardens, *Larix*

decidua, 25.vii.1964, 1 apt.; 13.viii.1961, 3 apt.; 9.ix.1962, 7 apt.; 22.ix.1962, 6 apt.; 14.x.1961, 1 ovipara; 26.x.1968, 1 ovipara (*V.F.E.*); Fernhurst, *Larix*



FIGS 14–18. *Cinara boereri*. 14–16, male genitalia, × 135. 17 & 18, aptera vivipara. 17, right siphunculus and part of fifth abdominal tergite, × 87. 18, second and third antennal segments, × 87.

decidua, 11.vii.1967, 1 apt., 1 alatoid nymph (*V.F.E.*); Richmond Park, *Larix*, 7.vii.1968, 1 apt. (*V.F.E.*); Wisley, R.H.S. gardens, 11.ix.1966, 1 apt. (*K. M. Harris & V.F.E.*); Kent, Wye, vagrant, June 1928, 1 al. (*F. V. Theobald*); London, Southgate, larch, 11.ix.1847, 1 apt. (*F. Walker*, 497); 2.ix.1847, 1 larva (495); 28.vii.1847, 1 al. (*F. Walker*, 499). Middlesex, Moor Park, *Larix decidua*, 15.vii.1962, 1 al. & larvae; 17.viii.1952, 1 apt. (*V.F.E.*). Herts, Harpenden, Rothamsted Experimental Station tower, 9.vi.1968, 1 al. (*N. R. Maslen*), Forestry Commission colln. Cambridge, Botanical Garden, *Larix decidua*, 10.vi.1952, 2 apt., 1 alatoid nymph (*V.F.E.*); 12.x.1950, 2 alate ♂♂ (*H. L. G. Stroyan* & colln.); *Larix dahurica* var. *pendula*, 15.viii.1951, 11 apt.; *L. sibirica*, 15.viii.1951, 1 apt., *L. dahurica*, 11.ix.1952, 3 apt.; *L. laricina*, 10.x.1950, 2 apt. (*V.F.E.*). Suffolk, Bury St Edmunds, Broom's Barn Expt. Stn, 29.vi.1968, 1 al. (*N. R. Maslen*), Forestry Commission colln. Yorks, Malton, High Mowthorpe Experimental Station, 30.vi.1968, 1 al.; 12.viii.1968, 1 al. (*N. R. Maslen*), Forestry Commission colln. Lancs, Meathorp Wood, larch, 5.ix.1966, 3 young larvae (*E. J. White*). Westmorland, Windermere, larch, 12.viii.1913, 2 ovip.; 16.viii.1913, 1 ♂ (*F. V. Theobald*). SCOTLAND: Edinburgh, Bush nursery, *Larix* grafts, 22.xi.1962, 1 al. ♂ (*C. I. Carter*, Forestry Comm. colln.).

AUSTRIA: Glochner, *Larix europaea*, 1.viii.1943, 1 apt. (*V. Pašek*). CZECHOSLOVAKIA: Banska Stiavnica, *L. decidua*, 20.viii.1951, 3 apt.; 4.ix.1949, 3 apt.; Polana, *L. decidua*, 20.vii.1951, 2 apt. (*V. Pašek*). 'Conifer' without further data, 1 apt., Theobald colln. GERMANY: Berlin Dahlem, *L. decidua*, 8.vii.1950, 1 apt., W. Quednau colln. (*K. Heinze*). ITALY: Zuel, nr. Cortina, *Larix*, 30.vii.1969, 5 apt., 1 al. (*V.F.E.*). NETHERLANDS: Bennekom, *L. decidua*, 15.x.1946, 1 apt. vivipara, 7 oviparae, 5 alate males (*D. Hille Ris Lambers* & colln.).

HOST-PLANTS. Specimens have been seen from *L. decidua* (= *europaea*), *L. gmelini* (= *dahurica*), *L. laricina* and *L. sibirica* and are also recorded from *Larix leptolepis*.

DISTRIBUTION. Specimens have been seen from Austria, Czechoslovakia, England, Germany, Italy, Netherlands and Scotland and have also been recorded from Bulgaria (Tashev, 1961 : 157), Latvia (Rupais, 1961 : 13–14), Mongolia (Szelegiewicz, 1963*b* : 113), Poland, Sweden, Switzerland, Ukraine and with a query from Yugoslavia (Rihar, 1963 : 264).

BIOLOGY. In England apterae viviparae have been collected in June, July and September, alatae viviparae from June 30th to August 12th, oviparae and alate males in October. Saeman (1966 : 379) gives an account of the biology. Alate males have been recorded from June to early August but have only been found in October and November in Britain. Attended by *Formica rufa* (according to Weis (1955 : 472) and by other ants (Pintera, 1966 : 319) in the wild but surviving in botanical gardens without ant attendance or with only occasional visits from *Lasius niger*.

NOTES. Closely related to *Cinara laricicola* (Matsumura) from Japan and to *C. laricifex* (Fitch) from America according to Hille Ris Lambers in Inouye (1962 : 152). Börner (1952 : 42) lists *Lachniella laricis cuneomaculata* Del Guercio, 1909, as a synonym of *C. kochiana* but the length of the tibiae agree better with *C. boerneri*. Important in apiculture in Central Europe, according to Börner & Franz (1956 : 29).

Cinara bogdanowi (Mordwilko)

? *Lachnus pruinosus* Hartig, 1841 : 368. [No types. GERMANY: Berlin], see Stroyan, 1957 : 349.
[*Aphis abietis* Walker, 1848 : 100, partim, 1 alata (see Doncaster, 1961 : 13).]
[*Aphis laricis* Walker, 1848 : 102, partim, 1st variety (see Doncaster, 1961 : 92).]
Lachnus bogdanowi Mordwilko, 1895*a* : 75, 79, 83, 94, 97–98. [Types unknown. Locality not given, presumably POLAND]; 1895*b* : 97, 115–118; Cholodkovsky, 1896*a* : 150; 1898*a* : 657–659; 1902 : 6.
Lachnus piceicola var. *viridescens* Cholodkovsky, 1896 : 509. [Types unknown. Locality not given, presumably U.S.S.R.]; 1898 : 662.
Neochmosis abietis (Walker) Theobald, 1929 : 362–354, partim.
Dilachnus radicicolus Wellenstein, 1930 : 739–743, 751. [Types unknown. Locality not given, presumably GERMANY.]
Cinara bogdanowi (Mordwilko) Börner, 1932 : 568; Braun, 1938 : 479; Szelegiewicz, 1962 : 79–80; Shaposhnikov, 1964 : 521; Pintera, 1966 : 309–311.
Cinara radicicola (Wellenstein) Börner, 1932 : 570.
Cinaropsis (*Pityaria*) *pruinosa* (Hartig) Börner, 1949 : 59; 1952 : 43.
Cinaropsis viridescens (Cholodkovsky) Börner, 1952 : 43.
Cinaria intermedia Pašek, 1952 : 96, nomen nudum; 1953 : 4–6. [Lectotype, Academy of Science, Prague. CZECHOSLOVAKIA]; 1954 : 153–155. **Syn. n.**
Cinaria borealis (Curtis) Pašek, 1953*c* : 225–226; 1954 : 216–218.
? *Cinaria* (*Mecinaria*) *radicicola* (Wellenstein) Aizenberg, 1956 : 139.
Cinara (*Cinaropsis*) *bogdanowi* (Mordwilko) Stroyan, 1957 : 349–351.
Cinaropsis (*Pityaria*) *bogdanowi* (Mordwilko) Heinze, 1962 : 168–169.
Cinara borealis (Curtis) Pintera, 1966 : 307–308.
Cinara (*Pityaria*) *bogdanowi* (Mordwilko) Canakçioglu, 1966 : 140.

MATERIAL EXAMINED.

ENGLAND: London, Southgate, Spruce, 3.vii.1847, 1 alata (*F. Walker*) (slide no. 7B); larch, 2.i.1847, 3 apterae (*F. Walker*) (496); 11.ix.1847, 4 apt. (*F. Walker*) (slide no. 497). Surrey, Wisley, *Picea schrenkiana*, 6.viii.1953, 1 apt. (*J. P. Doncaster*). Hants, Alice Holt, light trap, 4.vi.1964, 1 al., Forestry Commission colln.

BELGIUM: Jupille, *Picea excelsa*, 11.v.1961, 8 alatae (*J. Leclerq* coll.), H. L. G. Stroyan leg. CZECHOSLOVAKIA: Jakubov, *Picea excelsa*, 18.v.1950, 2 apterae, Gelnica, *P. excelsa*, 17.vi.1952, 2 apt., *P. excelsa* roots, 30.ix.1950, 2 apt., Ruské Peklany, *Picea excelsa*, 23.vi.1952, 2 apt., Bianska Stiavnica, *P. excelsa*, 22.vii.1952, 2 apt., Vysoká, *P. excelsa* roots, 16.ix.1952, 2 apt. (*V. Pašek*); Kotlina, 18.vi.1932, 1 al. (*D. Aubertin*) (*C. borealis* (Curtis) of Pasek). GERMANY; Moor, Fichten, 27.v.1934, 2 apt., (*Rebeler* coll.), K. Heinze leg. Oberhof, *P. excelsa*, 1.x.1937, 1 ovipara (*K. Heinze*). NETHERLANDS: Hoenderloo, *Picea*, 70.vi.1946, 6 oviparae (*Elton* coll.), D.H.R.L. leg.; Bennekom, *P. alba*, 1.x.1946, 4 oviparae, D.H.R.L. 2 colln. POLAND: Bydgoszoz Jachcice, *P. excelsa*, 4.viii.1956, 1 larva (*H. Szelegiewicz*). Without data, ? Poland, 3 apt., 1 alatoid nymph, ex. coll. Mordwilko. TURKEY: Artrim, Kurukürün, 1940 m., *Picea orientalis*, 1 apt.; Istanbul, Maslak, 100 m, *P. abies*, 2 larvae, 20.vi.1964 (*H. Szelegiewicz*).

HOST-PLANTS. Seen from *Picea abies* (= *excelsa*) and more rarely from other members of *Eupicea* such as *P. orientalis* and *P. schrenkiana* (= *tianshanica*) and also recorded from *P. glauca*.

DISTRIBUTION. Seen from Belgium, Czechoslovakia, England, Germany, Netherlands, Poland, and Turkey. Also recorded from Austria, Bulgaria, Norway, Ukraine, Moldavia, Latvia and Estonia.

BIOLOGY. Occurs on both the branches and the roots of spruce. Alatae viviparae occur from May until early July. Oviparae occur in October. According to Pintera (1966 : 311) the spring generations live on the two year old or older twigs in shady positions and alatae are produced in the third generation. The progeny of the alatae develop on the roots or at the base of the trunk. *Cinara bogdanowi* is attended by ants which construct special chambers around the roots for the aphids. Mating occurs after the sexuales have left the subterranean shelters and the oviparae lay eggs on the bark of the younger twigs. Wellenstein (1930 : 739–743) describes the oviparae and alate males as *Lachnus radicicolus*. Anholocyclic overwintering on the roots has been recorded.

NOTES. Said to be important for the production of 'forest honey' in Central Europe (Pintera, 1966 : 311). Inouye (1970 : 73–74) regards the Japanese *Cinara ezoana* Inouye, 1936, as a subspecies of *C. bogdanowi*.

Cinara brauni Börner

(Text-fig. 19)

? *Eulachnus nigrofasciatus* Del Guercio, 1909 : 316, 324–326. [Types unknown. ITALY: Firenze, *Pinus sylvestris*, 1905.]

Cinara brauni Börner, 1940 : 1. [Types, Deutsches Entomologisches Institut. Central Europe, *Pinus austriaca*]; Szelegiewicz, 1962 : 80; Tashev, 1964 : 172–173; Pintera, 1966 : 290, 291; Maslen, 1969 : 228.

Cinara (*Subcinara*) *brauni* Börner; Börner, 1949 : 59; 1952 : 41; Pašek, 1954 : 175–179.

MATERIAL EXAMINED.

ENGLAND: Hants, Alice Holt Gardens, suction trap, 20.vii.1968, 1 alata (*N. R. Maslen*), Forestry Commission collection.

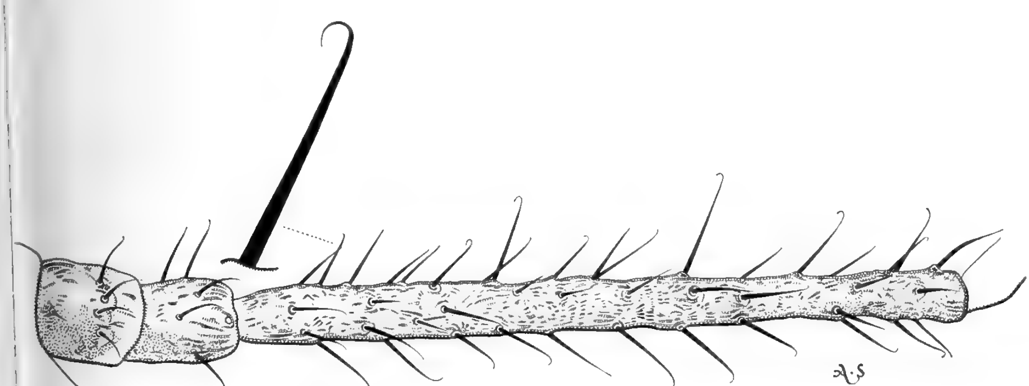


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FIG. 19. *Cinara brauni*, aptera vivipara. Antennal segments I–III, × 150.

AUSTRIA: Wien-Schwechat, *Pinus nigra*, 7.ix.1970, 4 apt. (*W. Quednau*). CZECHOSLOVAKIA: Banska Stiavnika, *P. nigra*, 7.vii.1952, 3 apterae, 1 al.; Detra, *P. nigra*, 8.viii.1952, 2 apt., 1 al. (*V. Pašek*). HUNGARY: Bükk, Fekete-sár, *P. nigra*, 9.ix.1965, 2 apt. viviparae, 1 ovipariform apt. (*H. Szelegiewicz* & colln. 2942). NETHERLANDS: Arnhem, *Pinus austriaca*, 26.viii.1955, 2 apt. (*D. Hille Ris Lambers*). POLAND: Bydgoszez-Osied. L., *Pinus nigra*, 8.viii.1957, 3 apt., 1 al.; Wladystawowo, distr. Puck, *P. nigra*, 8.vii.1960, 3 apt., 3 al. (*H. Szelegiewicz* & colln.). TURKEY: Istanbul, Bahceköy, 110 m a.m.s.l., *P. nigra* var. *pallasiana*, 18.vii.1963, 3 apt., 1 alatoid nymph; Istanbul, Bayazit, 80 m a.m.s.l., *P. nigra*, 7.vi.1964, 1 apt., 1 al.; Bursa-Uludag, Sarialan, 1600 m a.m.s.l., *P. nigra* var. *pallasiana*, 22.viii.1965, 7 apt. (*H. Çanakçioğlu*).

HOST-PLANTS. *Pinus nigra* (= *austriaca*), *P. nigra* var. *caramatica* (= *pallasiana*) and *P. nigra* var. *maritima* (= *laricio*).

DISTRIBUTION. Specimens have been seen from Austria, Czechoslovakia, England, Hungary, Netherlands, Poland and Turkey and are also recorded from Bulgaria, Germany and the Crimea.

BIOLOGY. According to Pintera (1966 : 291) it lives on young shoots attended by the ant *Formica rufa*.

Cinara costata (Zetterstedt)

(Text-fig. 20)

Aphis costata Zetterstedt, 1828 : 559. [Types, Entomologische Museum Lund, teste Wahlgren, 1939 : 3–4, Lappland]; 1840 : 311; Walker, 1848 : 100–102; 1852 : 957.

? *Cinara symphyti* Curtis, 1835 : no. 577, page 2. [Types unknown. ENGLAND: June, alatae] (see Walker, 1852 : 957; Hottes, 1949 : 159).

Lachnus costatus Hartig, 1839 : 645 (new species). [Types unknown. No locality, presumably GERMANY.]

Schizoneura costata (Hartig) Hartig, 1841 : 367; Walker, 1852 : 1050.

[*Lachnus fasciatus* Burmeister; Kaltenbach, 1843 : 160–161; Koch, 1856 : 237–238; Swain, 1921 : 211–212. Misidentifications.]

Dryobius cistatus [sic] Walker; Buckton, 1881 : 78.

Lachnus farinosus Cholodkovsky, 1892 : 74–75. [Types unknown. Without locality, presumably RUSSIA, near Leningrad]; 1896*a* : 145–146; 1898 : 650–654; van der Goot, 1915 : 395.

[*Lachnus fasciatus* (Kaltenbach) Mordwilko, 1895*a* : 102; 1895*b* : 104, 139–146.]

[*Lachniella fasciata* (Burmeister) Del Guercio, 1909 : 294–296, partim ?, alata only. Misidentification.]

Lachnus costatus (Zetterstedt) Jackson, 1919 : 164; Theobald, 1929 : 157–161.

[*Panimerus pinihabitans* (Mordwilko) Theobald, 1929 : 132–135 partim, the apterae from Windermere. Misidentification.]

Pterochlorus cistatus [sic] (Walker) Buckton; Swain, 1921 : 211.

Lachniella costata (Zetterstedt) Börner, 1932 : 571; 1952 : 45; Braun, 1938 : 482; Wahlgren, 1939 : 3–4; Pašek, 1954 : 195–197; Heinze, 1962 : 176–178; Higuchi & Miyazaki, 1969 : 31.

Cinara costata (Zetterstedt) Mordwilko, 1933 : 159; 1948 : 201; Inouye, 1937 : 105; Kloft, Kunkel & Ehrard, 1960 : 166–167; Hottes, 1961 : 41, 43; Szelegiewicz, 1962 : 81; Shaposhnikov, 1964 : 522; Pintera, 1966 : 311–314.

Cinara (*Lachniella*) *costata* (Zetterstedt) Eastop, 1966 : 528–529.

Cinara (*Cinaropsis*) *costata* (Zetterstedt) Inouye, 1970 : 84–85.

MATERIAL STUDIED.

ENGLAND: without further data, 1 alata (*F. Walker*), slide no. 266. London, Southgate, spruce, 5.vi.1847, 1 aptera, 2 alatoid nymphs (*F. Walker*), slide 677; 21.vi.1847, 1 al. (no. 269); 25.vi.1847, 2 al. & 1 immature (270, 271); 30.vi.1847, 4 apt., 1 al. (272); 3.vii.1847, 1 apt., 2 al. (276); 30.x.1847, 7 oviparae (274, 275, 277); 'scotch pine', 9. vi.1847, 1 al. (273); 'scotch fir', 18.vi.1847, 1 apt., 2 al. (*F. Walker*), slide no. 273. Kent, Wye, spruce, 5.vii.1913, 9 apt.; 19.v.1927, 13 apt.; '*Pinus sylvestris*', 5.v.1913, 1 apt., 3 alatoid nymphs (*F. V. Theobald*), the correct data for this sample is probably 'spruce' 27.v.1913, see data for *Cinara pinea* from Wye in May, 1913 on page 157. Herts, Redbourne, *Picea abies*, 13.v.1945, 4 apt., 4 al.; *Picea* sp., 13.v.1945, 8 apt., 4 al. (*J. P. Doncaster*). Harpenden, Rothamsted tower trap, 9.vi.1968, 1 al., Forestry Commission colln. Berks, Midgham, *Picea excelsa*, 15.v.1948, 9 apt. (*V.F.E.*). Gloucs., Cowley Manor, June 1959, 1 al. (*R. S. George*). Hants, Alice Holt, *Picea abies*, 14.vi.1967, 3 apt., 1 alatoid nymph (*H. C. Dale*). Somerset, Long Ashton, 1964, 1 al. (*A. Stringer*). Bucks, Slough, 1937, 2 apt., 2 al. (*H. Downes*). Cumberland, Great Salkeld, *Pinus sylvestris*, 20.vi.1914, 1 al. (*F. V. Theobald*), the alatoid nymph on the same slide is *Schizolachnus pineti*. Westmorland, Windermere, spruce, 5.v.1913, 3 immature (*F. V. Theobald*); 13.v.1915, 1 apt. (*R. Roberts*), F.V.T. colln.

CZECHOSLOVAKIA: Prague, flying, 2.vi.1964 (*V.F.E.*). GREENLAND: 1929, stomach of Phalarope, thorax and abdomen of 1 al. (*O. W. Richards*). NETHERLANDS: Bennekom, *Picea* sp., 21.vi.1949, 3 apt., 2 al. (*D. Hille Ris Lambers & H. L. G. Stroyan* coll.), H.L.G.S. colln. JAPAN: Hokkaido, Sapporo, Mt Soranumar, *Picea* sp., 3.vii.1964, 3 apt. (*H. Takada*). POLAND: Bydgoszcz-Jacheire, *Picea excelsa*, 4.viii.1956, 1 apt. (*H. Szelegiewicz*).

AUSTRALIA: New South Wales, Mittagong, '*Abies excelsa*', 25.ix.1959, 7 apt.; '*Picea coseana glauca*', 25.ix.1959, 3 apt. (*V.F.E.*). Tasmania, Oaklands, *Picea*, 22.v.1952, 2 larvae, Tasmania Dept. Agriculture colln. CANADA: Ontario, Ottawa, *Picea abies*, 4.vi.1951, 1 apt. (*W. R. Richards*).

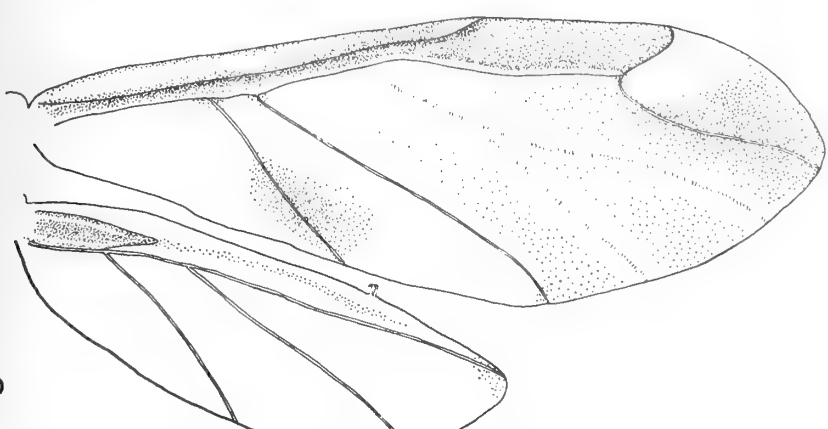

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FIG. 20. *Cinara costata*. Wings, × 24.

Host-plants. *Picea abies* (= *excelsa*) and also recorded (Pintera, 1966 : 312) from other *Eupicea* such as *Picea glauca*, *P. glehni* and *P. pungens* and from *P. jezoensis* in the *Cascita* group and *P. omorika* of the *Omorika* group.

Distribution. Specimens have been seen from Czechoslovakia, England, Greenland (from stomach of Phalarope), Netherlands, Japan, Poland, New South Wales, Tasmania and Ontario. *Cinara costata* has also been recorded from Austria, Finland, Germany, Norway, Scotland, Sweden, U.S.S.R., Ukraine, Latvia, Estonia, Sachalin, Yugoslavia, California (see 'Notes') and Washington.

Biology. Numerous apterae and some alatae can be collected in May in England and apterae are less common in June. Occasional apterae and alatae have been collected in July. Oviparae occur in October. *C. costata* seems not to have been collected in Britain during August or September. According to Pintera (1966 : 312–313) *C. costata* lives on the older twigs all the year and is not or only rarely attended by ants. In September, 1959 in New South Wales, it was found both on the second year twigs and on the lower branches covered with earth, apparently by ants. Cholodkovsky (1892 : 74–75) gives an account of the biology, including alate males, presumably near Leningrad.

Notes.

The type-species of *Lachniella* Del Guercio, 1909 (*as fasciata*)

Lachniella is a real species-group in the sense that there are a number of species of similar appearance with similarly pigmented wings, few rhinaria on the antennae of the alatae and oviparae with strongly swollen hind tibiae. Otherwise the species are similar to *Cinaropsis* and perhaps *Cinaropsis* should be regarded as a synonym of *Lachniella*, used as a sub-genus of *Cinara*. The confusion concerning the use of *Lachniella* resulted from *Lachnus fasciatus* Burmeister, 1835 being selected as the type-species of *Lachnus* Burmeister by Westwood, 1840, without there being agreement as to the identity of *Lachnus fasciatus*. Some authors regarded *L. fasciatus* as a synonym of *Lachnus roboris* (L.) and others as a synonym of *Lachnus costatus*.

Cinara nimbata Hottes, 1954, from North America is similar to *costata* but bears shorter and thicker hairs. It is not clear whether the record of *costata* from *Picea sitchensis* in California by Hottes & Essig (1953 : 172) really applies to *costata* or to the species subsequently described as *Cinara sitchensis* Hottes, 1958.

Cinara cupressi (Buckton)

(Text-fig. 21)

Lachnus cupressi Buckton, 1881 : 46–47. [Types BMNH. England]; Cholodkovsky, 1898 : 669–670.

Lachnus juniperinus Mordwilko, 1895*a* : 75, 79, 82, 94, 102. [Types unknown. Poland]; 1895*b* : 103–104, 134–136; Cholodkovsky, 1898 : 668–669.

Lachniella juniperinum (Mordwilko) Del Guercio, 1909 : 305–306.

Lachniella tujae Del Guercio, 1909 : 288, 309–310. [Types unknown. *Tuja* without other collection data, presumably Italy.]

? *Lachniella juniperi signata* Del Guercio, 1909 : 289, 314–315. [Types unknown. Italy, nr Firenze, *Thuja occidentalis*.]

[*Lachnus juniperi* (De Geer); Essig, 1911 : 541–543; van der Goot, 1915 : 396–399. Misidentification.]
Dilachnus cupressi (Buckton) Swain, 1921 : 212–213.
Lachnus sabinae Gillette & Palmer, 1924 : 9–11. [Types. COLORADO: Fort Collins, *Sabina* (= *Juniperus*) *scopulorum*.] **Syn. n.**
Panimerus cupressi (Buckton) Theobald, 1929 : 148–149.
[*Panimerus juniperi* (De Geer) Theobald, 1929 : 151 partim, the specimens from *Juniperus virginiana* at Kew. Misidentification.]
Panimerus tujae (Del Guercio) Theobald, 1929 : 153–154.
Cinara sabinae (Gillette & Palmer) Gillette & Palmer, 1931 : 867; Palmer, 1952 : 45.
Cinara cupressi (Buckton) Börner, 1932 : 570; Braun, 1938 : 480; Hottes & Essig, 1953 : 172; Szelegiewicz, 1962 : 83.
Cinara thujae (Del Guercio) Braun, 1938 : 480.
Neochmosis cupressi (Buckton) Kloet & Hincks, 1945 : 70.
Neochmosis tujae (Del Guercio) Kloet & Hincks, 1945 : 70.
Cupressobium cupressi (Buckton) Börner, 1952 : 45.
Cinara canadensis Hottes & Bradley, 1953 : 86–87. [Type, Canadian National Collection, Ottowa: ONTARIO, *Juniperus virginiana*.] **Syn. n.**
Cinara (*Cupressobium*) *cupressi* (Buckton) Eastop, 1958 : 93.
Cinara juniperina (Mordwilko) Ossiannilsson, 1959 : 379.
Cupressobium juniperinum (Mordwilko) Heinze, 1962 : 174–176
[? *Cinara tujafilina* (Del Guercio); Tashev, 1944 : 173. Misidentification.]

MATERIAL STUDIED.

ENGLAND: Cornwall [Probus, cypress], 17.xi.[1879], 4 apterae (*J. T. Roscawen*) type-series of *cupressi*). Gloucs., Long Ashton, *Cupressus* sp., May–June 1937, apt. (*C. L. Walton*). Somerset, Weston-super-Mare, *Cupressus macrocarpus*,

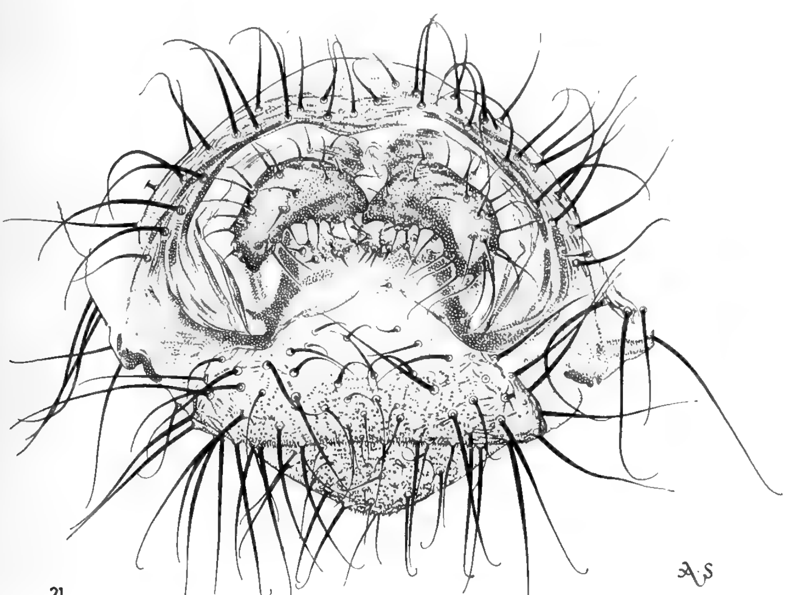

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FIG. 21. *Cinara cupressi*. Male genitalia, × 000.

June 1937, 4 apt.; cypress, June 1937, 2 apt. (*C. L. Walton*); Bristol, *Thuja* sp., 7.vii.1913, 7 apt., 1 alata (*F. V. Theobald*). Surrey, Kew Gardens, *Juniperus virginiana*, 23.viii.1919, 4 apt. (*F. Laing*); Wimbledon, *Thuja* sp., 5.vi.1935, 2 apt. (*C. T. Gimingham*); Wisley, *Cupressus macrocarpus*, 20.ix.1923, 17 apt. (*F. V. Theobald*). Berks, Reading, *C. macrocarpus*, 16.vi.1957, 5 apt., 1 al., Eastwood's nursery; *Cupressus* sp., 3.vi.1950, 1 apt. (*V.F.E.*); Ascot, Silwood Park, 40′ suction trap, 10.viii.1968, 1 al., Forestry Commission Colln. Bucks, Slough, R.C.S. Research Station, cypress, June 1937, 2 apt., 3 al. (*Downes*). Kent, Bedgebury Pinetum, *Juniperus chinensis*, 8.vii.1969, 1 al.; Wye College, suction trap, 6.viii.1969, 1 al. (*N. R. Maslen*).

Czechoslovakia: Bianska Stiavnica, *Biota orientalis*, 9.v.1950, 1 apt. (*V. Pašek*). Germany: Bad Zwischenghr, *Juniperus virginiana*, 12.v.1959, 2 ? fundatrices (*Gunkel* coll.), K. Heinze leg. Friedhof, *Thuja occidentalis*, 31.x.1957, 1 ovipara (*K. Heinze*). Berlin, *T. occidentalis*, October 1953, 6 ovip., 1 alate male (*D.E.J.*), D. Hille Ris Lambers colln. Netherlands: Nalkenburg Z. l., *T. occidentalis*, 7.v.1930, 1 apt. (*D.H.R.L.*); Wageningen, *Thuja occidentalis ohlendorffi*, 19.vi.1954, 29 apt., 5 al. (*D.H.R.L. & J. P. Doncaster*). *T. occidentalis*, 2 ovip., 2 al. males, October, 1940 (*D.H.R.L.*). Poland: Olsztyn, *T. occidentalis*, 18 apt. (*S. Huculak*). Turkey: Bacekoy, Istanbul, *Cupressus goveniana*, 10.iii.1966, 7 apt. (*H. Çanakçioğlu*).

Canada: British Columbia, Kelowna, *Juniperus scopulorum*, 5.vi.1962, 1 apt. (*G. A. Bradley*). U.S.A.: Penn., Waddle, The Rock, *Juniperus virginiana*, 13.vi.1965, 4 apt., 1 al.; 7.ix.1964, 3 apt. (*J. O. Pepper*).

Host-plants. *Thuja occidentalis*, *Cupressus goveniana*, *C. macrocarpa*, *Juniperus virginiana* and occasionally *Juniperus scopulorum* and *Thuja orientalis*.

Distribution. Specimens have been seen from Czechoslovakia, England, Germany, Netherlands, Poland, Turkey, British Columbia and Pennsylvania, and are also recorded from Iraq, Italy, Latvia, Sweden, Ukraine and Ontario (original description of *canadensis*).

Biology. Apterae viviparae live on the aerial parts of the hosts from May to September and were described from November in Cornwall where the winter is mild. Alatae viviparae are produced between mid June and mid August and oviparae and alate males in October. Gunkel (1963*a* : 1–48 & 1963*b* : 329–341) has given an account of the natural enemies and population dynamics of *Cinara cupressi*.

Notes. Takahashi's record (1941 : 150) of *C. cupressi* from *Cupressus torulosa* in Victoria was most probably based on specimens of *Cinara fresai*. *Lachnus juniperinus* seems to be a synonym of *Cinara cupressi* but Eastop (1966 : 528) and perhaps Braun (1938 : 480) applied the name *Cinara juniperina* (Mordwilko) to *C. fresai*.

The apparently discontinuous host-plant preferences have led to a number of synonyms. Specimens from *Juniperus virginiana* have been described as *Cinara canadensis* and from *J. scopulorum* as *Cinara sabinae*.

Much of the description of *Cinara difficilis* Hottes & Frison, 1931, from *Juniperus virginiana*, agrees with *C. cupressi* but the hairs on the body and appendages of *difficilis* are shorter than in *cupressi* and the ultimate rostral segment of *difficilis* bears about 20 accessory hairs distributed over both surfaces.

Cinara escherichi (Börner)

[*Lachnus nudus* (De Geer) Mordwilko, 1895*a* : 78, 79, 81, 82, 99; 1895*b* : 100, 119–124; Cholodkovsky, 1898 : 635, 642–643. Misidentifications.]
? *Lachniella picta* Del Guercio, 1909 : 293–294. [Types unknown. ITALY: Monte Boni, *Pinus sylvestris*, 27.v.1905, aptera.]
Cinara nuda (Mordwilko) Hottes, 1930 : 186–187; Pintera, 1966 : 314.
Cinaria escherichi Börner, 1950 : 2. [Types Deutsches Entomologisches Institut. AUSTRIA: Burgenland]; 1952 : 43; Pašek, 1954 : 148, 149–151; Heinze, 1962 : 162.
Cinara escherichi (Börner) Kloft, Kunkel & Ehrhardt, 1960 : 165; Szelegiewicz, 1962*a* : 81.

MATERIAL STUDIED.

ENGLAND: Hants, Alice Holt, suction trap, 24.vi.1967, 1 alata (*C. I. Carter & N. R. Maslen*), Forestry Commission colln.

CZECHOSLOVAKIA: Jakubov, *Pinus sylvestris*, 19.i.1950, 2 fundatrices; Banska Stiavnica, *P. sylvestris*, 10.v.1950, 1 aptera; 7.vi.1952, 2 al.; 3.viii.1952, 2 apt. (*V. Pašek*). POLAND: Bydgoszcz-Jachcice, *Pinus sylvestris*, 12.viii.1957, 3 apt., 3 al.; Stamirowice distr., Grojec, *P. sylvestris*, 18.viii.1961, 4 apt. (*H. Szelegiewicz* & colln.).

HOST-PLANT. *Pinus sylvestris*.

DISTRIBUTION. Originally described from Austria, specimens have been seen from Czechoslovakia, England and Poland, and have also been recorded from Germany.

BIOLOGY. According to Pintera (1966 : 314) *Cinara escherichi* lives in large colonies on the trunk or basal parts of the older branches in the spring and in rather smaller colonies or individually under the bark during the summer. The colonies are attended by ants.

NOTES. *Cinara escherichi* is a member of the '*pini*-group', generally similar to *C. acutirostris* but bears more numerous but shorter hairs. Authors after Mordwilko, 1895, and before Szelegiewicz, 1962, who refer to *Cinara nuda*, were applying the name to *C. pini* (L.) or to one of its subspecies. *Cinara canatra* Hottes & Bradley from *Pinus banksiana* in North America is similar to *C. escherichi* except for the pigmented dorsum of *C. canatra* and that the second antennal segment of the summer apterae viviparae of *C. escherichi* bear 9–13 hairs, while the second antennal segments of *C. canatra* bear 5–10 hairs. The eighth abdominal tergite of *C. canatra* bears 10–14 hairs while the eighth tergite of the summer apterae of *C. escherichi* bears 14–23 hairs.

Cinara fresai Blanchard

[? *Cinara juniperina* (Mordwilko) Braun, 1938 : 480. Misidentification.]
Cinara fresai Blanchard, 1939 : 860–862. [Types Instituto de Sanidad Vegetal, Buenos Aires; ARGENTINA: Tandil, *Cupressus macrocarpa*, alata.]
[*Cinara cupressi* (Buckton); Takahashi, 1941 : 150. Misidentification.]
Cinara wacasassae (Tissot, 1945 : 49–52. [Types Florida Agricultural Experiment Station Gainsville; U.S.A.: Florida.] **Syn. n.**
[*Cinara juniperi* (De Geer); Cottier, 1953 : 77–81. Misidentification.]
? *Cupressobium mordwilkoi* Pašek, 1954 : 306–309; Heinze, 1962 : 174.
[*Cinara* (*Cupressobium*) *cupressi* ? *juniperina* (Mordwilko) Eastop, 1961 : 75. Misidentification.]
? *Cinara mordwilkoi* (Pasek) Szelegiewicz, 1962 : 84.
? *Cinara* (*Cupressobium*) *mordwilkoi* (Pašek) Shaposhnikov, 1964 : 524.
Cinara maui Bradley, 1965 : 668–670. [Types Forest Entomology Laboratory, Winnipeg; HAWAII: *Cryptomeria japonica*, apterae.] **Syn. n.**
[*Cinara* (*Cupressobium*) *juniperina* (Mordwilko) Eastop, 1966 : 528; Mound, 1969 : 62. Misidentification.]

MATERIAL STUDIED.

ENGLAND: Surrey, Farnham, Alice Holt Research Station, *Juniperus sabina* var. *tamariskifolia*, 25.vi.1956, 2 apterae and alatoid nymph (*D. Bevan* coll.), via C. I. Carter. Ham, *Juniperus horizontalis*, 2–31.x.1966, 27 apt., 3 alatae (*L. A. Mound*).

AUSTRALIA: New South Wales, Wentworth Falls, *Cupressus arizonica*, 30.i.1958, 8 apt. (*K. M. Moore*) (4 in N.S.W. Forestry Dept. colln.); Elizabeth Bay, *Cupressus* sp., 21.i.1963, 12 apt. (*Webster* coll.), via K. M. Moore; Collaroy, *Cupressus brunniana*, 8.vi.1962 (*G. P. Wright* coll.), via K. M. Moore; Mittagong, *Cupressus torulosa*, 25.ix.1959, 2 alatae and one first instar larva (*V.F.E.*). A.C.T., Canberra, flying, 22.viii–12.ix.1959, 3 al.;? *Cupressus* sp., 1–5.ix.1959, 4 apt., 3 al., *Cupressus sabina*, 3–10.ix.1959, 5 apt., 7 al.; 3.x.1959, 2 apt. & alatoid nymphs. *Juniperus* sp., 6.ix.1959, 6 al., 6 larvae. 'Juniper or cypress', 3.ix.1959, 3 apt. *Cupressus* sp., 16.xi.1959, 8 apt. (*D. Goodchild*) (4 apt. in C.S.I.R.O. colln.). Tasmania, Claremond, cypress, 12.viii.1957, 2 apt., 3 al.; Margate, *Cupressus macrocarpa*, 23.xii.1964, 5 apt. (*E. J. Martyn*). Victoria, Melbourne, Brighton Beach, *Cupressus* sp., 2.v.1959, 13 apt., 2 al. (4 apt. now in colln. A. Pintera); 21–25.vi.1959, 6 apt., Melbourne, *Cupressus lambertiana*, near ends of twigs, 26.v.1959, 3 apt. ? *Cupressus*, 8.vii.1959, 4 apt. (*V.F.E.*). Maffra, Mt. Lithgow, 14.iv.1938, 2 apt., Victoria Dept. Agric.

CHILE: Plazoleta Yungue, Mas A Tierra, Islas Juan Fernadez, *Cupressus* sp., 7.iii.1968, 2 apt. (*C. W. O'Brien* coll., leg. & 1 in colln A. G. Robinson).

U.S.A.: California, Berkeley, *Juniperus* ? *scopulorum*, 23.iii.1964, 1 apt., 3 al. (*V.F.E.*). San Diego, *Juniperus* sp., 30.iii.1964, 2 al. & larvae (*R. C. Dickson, O. Heie & V.F.E.*). Florida, St Augustine, *Juniperus silicicola*, 19.iv.1945, 1 apt., 1 al. (*A. N. Tissot*) (metatypes of *C. wacasassae*). Oregon, Portland, meyer juniper, 8.i.1963, 2 apt. (*F. P. Larson* coll.), G. F. Knowlton leg.

HOST-PLANTS. *Juniperus horizontalis, J. sabina, J. silicicola* and more rarely *J. chinensis, J. scopulorum* and *J. squamata*; *Cupressus macrocarpa, C. torulosa* and more rarely *C. arizonica,* and recorded from *Cryptomeria japonica* as *Cinara maui.*

DISTRIBUTION. Specimens have been seen from England, New South Wales, Tasmania, Victoria, Chile, California, Florida and Oregon and have also been recorded from New Zealand.

BIOLOGY. Alatae viviparae have been found in both June and October in England. Sexuales are unknown, unless *Cinara mordwilkoi* is a synonym. An aphid of sporadic appearance, it was common in Melbourne, Victoria from May to July 1959 and at Canberra, A.C.T. from August to December 1959, but has apparently not been common there since (R. D. Hughes, personal communication). *Cinara fresai* lives under the older branches with ants and alatae viviparae are produced in large colonies.

NOTES. Braun (1938 : 480) keys out *Cinara juniperina* as having a body-length of more than 3 mm, the fifth antennal segment as long as the sixth and living on *Juniperus.* He does not give locality data. Pašek's (1954 : 306–309) description of *Cinara mordwilkoi* may also apply to *Cinara fresai* but it is not likely since Pintera and Szelegiewicz found mostly oviparae while *fresai* is known only from viviparae. If *C. mordwilkoi* is distinct from *fresai,* then Braun's (1938) record of *juniperina* probably applies to *mordwilkoi.* Schouteden (1906 : 203) records *Lachnus* ? *juniperinus* from *Juniperus communis* in Belgium. The first European specimens seen during this study were collected in 1956.

Cinara fresai is almost unique in *Cinara* in that the radial sector of the fore wing often does not reach the wing apex; this character is well illustrated in the original description. In occasional specimens of *C. fresai* the radial sector does reach the wing apex in the typical *Cinara* manner and in occasional specimens of *C. tujafilina* the radial sector does not quite reach the wing apex.

Cinara juniperi (De Geer)

Aphis juniperi De Geer, 1773 : 56–58. [Types unknown. Locality not given]; 1780 : 38; 1783 : 77; Fabricius, 1781 : 388; 1794 : 218.
Lachnus juniperi (De Geer) Kaltenbach, 1843 : 153–154; Koch, 1856 : 243–244; Mordwilko, 1895*a* : 101; 1895*b* : 103, 136–139; Cholodkovsky, 1898 : 667–668; 1902 : 7.
Lachniella juniperi (F.) Del Guercio, 1900 : 108; 1909 : 312–314; Jackson, 1919 : 164.
Dilachnus juniperi (De Geer) Swain, 1921 : 213.
Cinara juniperi (De Geer) Börner, 1932 : 57; Mordwilko, 1933 : 169; Mimeur, 1936*b* : 253; Braun, 1938 : 480; Hottes, 1955 : 103; Szelegiewicz, 1962 : 82.
Neochmosis juniperi (De Geer) Kloet & Hinks, 1945 : 70.
Cupressobium juniperi (De Geer) Börner, 1952 : 44; Pašek, 1954 : 304, 305–306; Heinze, 1962 : 174.
Cinara (*Cupressobium*) *juniperi* (De Geer) Eastop, 1958 : 93; Shaposhnikov, 1964 : 524.
[? *Cinara mordwilkoi* (Pašek) Szelegiewicz, 1962 : 84. Misidentification.]

MATERIAL STUDIED.

ENGLAND: London, Southgate, juniper, 4.vi.1847, 7 apterae, 4 alatae (*F. Walker*)

(slide nos. 459 & 560); 25.vi.1847, 7 apt., 1 al. (461); 21.viii.1847, 2 apt. (463); 30.x.1847, 3 apt. (*F. Walker*), 462. Kent, Wye, juniper, May 1913, 3 al., June 1913, 1 apt. (*F. V. Theobald*). From *Juniperus communis*, Trottiscliffe Park, August, 1968, 1 apt.; Crookhorn Wood, November 1968, 2 apt.; Shoreham, White Hill, January 1969, 1 apt. (*L. K. Ward*). Surrey, Wisley, *Juniperus communis*, 30.vii.1953, 11 apt. (*J. P. Doncaster*); *J. communis effusa*, 22.v.1968, alatoid nymphs (*K. M. Harris*); *J. communis hibernica*, 14.v.1968, 11 apt., 2 al. & many alatoid nymphs; *J. communis nana*, 22.v.1968, 1 al. & alatoid nymph; *J. chinensis kewensis*, 22.v.1968, 5 alatoid nymphs, 4.ii.1969, 9 apt. (*K. M. Harris*). Kew Gardens, *J. chinensis*, 26.ix.1960, 7 apt. (*V.F.E.*). Wimbledon, 'sallow catkins', 16.v.1930, 1 al. (*C. N. Hawkins*); Mickleham Down, juniper, 2.vi.1925, 3 apt. (*F. Laing*). Mickleham Common, juniper, 26.xi.1922 (*W. E. China*). From *Juniperus communis*, Riddlesdown, 7.vi.1968, 2 al.; January 1969, 2 apt. Newlands Corner, July 1968, 1 apt. Walton Down, August 1968, 2 apt.; January 1969, 1 apt.; Park Down, October 1968, 1 apt.; Hackhurst Down, January 1969, 5 apt. (*L. K. Ward*). Berks, Streatly, Green Hill, *J. communis*, July 1969, 2 apt. (parasitized); October 1969, 2 apt. (parasitized); Hogtrough Bottom, *J. communis*, April 1969, 2 apt.; May 1969, 3 al.; July 1969, 1 apt. (parasitized) (*L. K. Ward*). Oxon, Ewelme Park, May 1969, 1 al.; Ewelme Down, July 1969, 2 apt. (parasitized); September 1969, 2 apt.; Aston, Rowant, July 1969, 2 apt.; Nuffield Common, June 1969, 1 apt., 1 al.; July 1969, 1 apt.; Peppard Common, April 1969, 1 apt.; July 1969, 2 apt. (parasitized); October 1969, 2 apt.; Bix Bottom, July 1969, 1 apt. (*L. K. Ward*). Bucks, *J. communis*, Bledlow, 25.ix.1919, 2 apt. (*F. Laing*). Whiteleaf, 5.viii.1951, 2 apt. (*V.F.E.*). High Wycombe Hill, May 1969, 1 al.; West Wycombe Hill, April 1969, 5 apt., 1 brachyptera; May 1969, 3 apt., 3 al. (*L. K. Ward*). Herts, Harpenden, Rothamsted trap F.1, 22.v.1943, 1 al. (*J. P. Doncaster*). Rothamsted tower trap, 31.v.1968, 1 al., Forestry Commission colln. From *Juniperus communis*, Aldbury, 11.viii.1944, 4 apt. (*J.P.D.*); Aldbury Hill, July 1969, 4 apt. (*L. Ward*); Gustard Wood nr. Harpenden, 30.iv.1957, 4 apt. (*H. L. G. Stroyan* & colln.); Albury Hill, October 1969, 1 apt.; Commonwood Common, May 1969, 2 apt., 4 al. (*L. K. Ward*). Cambridge, *Juniperis communis*, University botanical garden, 9.v.1952, 16 apt., 21.vi.1951, 1 apt. (*V.F.E.*); 9.iv.1954, 1 apt. (*H.L.G.S.* & colln.). Fleam Dyke, May 1969, 3 apt., 2 al., 2 alatoid nymphs; July 1969, 3 apt.; October 1969, 3 apt. (*L. K. Ward*). Northumberland, Alnwick & Wooler, *J. communis*, May (prior to 1881), 2 al. (*Hardy*), G. B. Buckton slide no. 232. Berwick, 2 apt. (prior to 1881), G. B. Buckton, 233. Cheviott, May (prior to 1881), 2 al. (*Hardy*), G. B. Buckton, 234. SCOTLAND: Sutherland, Brora, *J. communis*, 11.v.1936, 2 apt. (*G. D. Morrison*). Perthshire, Trossachs, juniper, 28.vi.1932, 1 apt., 3 al. (*W. H. T. Tams*). Pitlochry, juniper, September 1920, 7 apt. (*F. V. Theobald*). Kincardine, Banchorry, *Juniperus*, 5.vi.1964, 8 apt., 1 alatoid nymph (*L. A. Mound*). Inverness, Juniper, July 1933, 1 apt. (*G. D. Morrison*). Nethybridge, *J. communis*, 6.viii.1940, 1 apt., 1 al. (*G. D. Morrison*). Banffshire, Mortlach, 14.vii.1938, 2 apt. (*G. D. Morrison*). Aberdeen, Glen Gairn, 17.viii.1940, 3 immature (*G. D. Morrison*). WALES: Glams., Gower Slade Cliffs, limestone, *J. communis*, 18.v.1964, 1 apt., 7 al. (*H. L. G. Stroyan* & colln.).

AZORES: Pico, N. slopes, *Juniperus oxycanus*, 9–17.vii.1929, 5 apt., 4 al. (*J. Balfour-Browne*). GUERNSEY: Couture, *Juniperus*, 11.vi.1951, 15 apt., 2 alatoid nymphs (*V.F.E.*). CZECHOSLOVAKIA: Banska Stianvika, *J. communis*, 5.v.1950, 3 fundatrices (*V. Pašek*). GERMANY: Naumberg, *J. communis*, summer 1932, 1 apt., 1 alatoid nymph; Wittental, *J. communis*, 15.vi.1961, 3 apt. (*K. Heinze*). Wildberg, (Black Forest), *J. communis*, 27.vii.1969, 4 apt. (*V.F.E.*). MAJORCA: Clan Picafort, 4.v.1969, 2 apt. (*D. J. Williams*). NETHERLANDS: Wageningen-Hoog, *J. communis*, 1.v.1938, 3 apt., ? fundatrices (*D. Hille Ris Lambers*). NORWAY: Ås, Vollebekk, trapped, 7.vii.1954, 1 al. (*H. Tambs-Lynche*). SWITZERLAND: Zenegger Wallis, *J. communis*, 21.v.1947, 2 apt., ? fundatrices (*Stäger* coll.), D. Hille Ris Lambers colln. TURKEY: Bolu-Aladag ormani, 1600 m, *Juniperus nana*, 3.vii.1964, 33 apt., 1 al. (*H. Çanakçioğlu*).

NEW ZEALAND: Auckland, *Juniperus*, 11-12.i.1960, 59 apt., 1 alatoid nymph (*V.F.E.*).

CANADA: Seattle, juniper, 29.iii.1940, 1 apt. (*C. L. Richie*).

HOST-PLANTS. *Juniperus chinensis* including *kewensis*, *J. communis* including *depressa*, *effusa*, *hibernica* and *nana*, rarely *J. oxycanus* and has also been recorded from *J. oxycedrus*, *J. rigida* and *J. squamata*.

DISTRIBUTION. *Cinara juniperi* has been seen from the Azores, Czechoslovakia, England, Germany, Guernsey, Majorca, Netherlands, Norway, Scotland, Switzerland, Turkey, Wales, New Zealand and 'Canada, Seattle'. Also recorded from Austria, Belgium (Schouteden, 1906 : 203), Bulgaria (Szelegiewicz, 1962*a* : 48), Greenland (Hille Ris Lambers, 1952 : 127), Latvia (Zirnits, 1927 : 251), Morocco, Poland, Ukraine, Bokhara (Jakhontov, 1929 : 15), Sweden, Japan (on *Juniperus rigida*: Inouye, 1970 : 89–91), Taiwan (on *Juniperus squamata*: Takahashi, 1937 : 2–3), Minnesota (Oestlund, 1922 : 118) and Ontario (MacNay, 1953 : 4).

BIOLOGY. *Cinara juniperi* is anholocyclic in Southern England and Wales with alatae viviparae found only in May and June. Apterae viviparae are common in May and June and occur more sparsely on the aerial parts of Juniper during the rest of the year. Alatae are also found in Scotland in June but a single alata collected in August has also been seen. It seems that *Cinara juniperi* is holocyclic in Central Europe. *C. juniperi* may be a widespread anholocyclic form of a more restricted species, holocyclic on *Juniperus communis*, for which the name *C. mordwilkoi* (Pašek) may be available. Rupais (1961 : 17–18) records *Cupressobium mordwilkoi* from Latvia.

Cinara kochiana (Börner)

(Text-figs 22–25)

[*Aphis laricis* Walker, 1848 : 102–103, partim, oviparae and probably '1st var.' (see Doncaster, 1961 : 93); 1852 : 957.]

? *Lachnus laricis* Koch, 1856 : 241–243 partim. [No types, locality not stated, presumably GERMANY]; Cholodkovsky, 1898 : 666 partim.

? *Lachniella laricis cuneomaculata* Del Guercio, 1909 : 291–293. [Types unknown. ITALY: Pratolina, *Larix europaea*, July, aptera.]

Cinara laricis (Koch) Braun, 1938 : 482, 483, 488–491, ? partim.
Cinaria kochiana Börner, 1939 : 76. [Said to be nom. n. pro *laricis* Koch nec Walker, 1848, but probably not Koch's species. Börner's material in Deutsches Entomologische Institut. Neither Börner nor Koch gave locality data but both probably from Germany or Austria.]
? *Cinara kochi* Inouye, 1939 : 138–141. [Said to be a nom. n. pro *laricis* Koch, 1857 nec Walker, 1848, as interpreted by Braun (1957 : 488–491), but Inouye describes five oviparae from JAPAN: Hokkaido, *Larix kaempferi*, 13.xi.1936. Types Govt. Forest Experiment Stn., Hokkaido.]
Cinaria (*Laricaria*) *kochiana* Börner; Börner, 1949 : 59.
Laricaria kochiana (Börner) Börner, 1952 : 42; Pašek, 1954 : 247–256; Heinze, 1962 : 160, 162.
Cinara (*Laricaria*) *kochiana* (Börner) Stroyan, 1957 : 348–349.
Cinara kochiana (Börner) Hille Ris Lambers, 1956 : 246; Kloft, Kunkel & Ehrhardt, 1960 : 161–164; Szelegiewicz, 1962 : 83; Shaposhnikov, 1964 : 523; Pintera, 1966 : 316–318.

MATERIAL STUDIED.

ENGLAND: London, Southgate, larch, 16.x.1847, 3 oviparae (*F. Walker*), slides 500 & 501.

CZECHOSLOVAKIA: Banska Stiavnika, *Larix decidua*, 7.vi.1952, 2 apterae viviparae (*V. Pašek*), D. Hille Ris Lambers colln.; 23.vi.1952, 1 apt. (*V. Pašek*), BMNH. NETHERLANDS: Putten, *Larix leptolepis*, 11.viii.1952, 2 apt. (*Elton* coll.), D.H.R.L. colln. Bennekom, *L. decidua*, 19.x.1946, 1 ovip.; Arnhem, *L. leptolepis*, 29.x.1952, 2 ovip.; November 1952, 1 ovip., 1 alate male (*D. Hille Ris Lambers* & colln.). POLAND: Chetmowa Gora pow. Kieke, *Larix polonica*, 20.x.1961, 7 apt., 1 al. (*H. Szelegiewicz* & colln.). SWEDEN: Brunnhy, Kullen, *Larix decidua*, 25.viii.1964, 1 apt. (*F. Ossiannilsson* & colln.). KOREA: Mt Chiri, *Pinus koraiensis*, 15.vi.1963, 1 apt. (*Woon Hah Paik*).

HOST-PLANTS. *Larix decidua* (= *europaea*, including *polonica*) and *L. leptolepis* (= *kaempferi* Sarg.) and also recorded from *Pseudolarix amabilis* (= *kaempferi* Gord.).

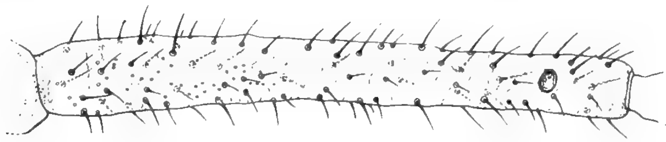
DISTRIBUTION. Specimens have been seen from Czechoslovakia, England, Netherlands, Poland, Sweden and Korea (subsp. *kochi* see Paik, 1965 : 18–19) and are also recorded from Austria, Germany, Italy, Rumania, Ukraine and the sub-species *kochi* from Japan.

BIOLOGY. According to Pintera (1966 : 318) *Cinara kochiana* lives at the bases of the older branches near the trunk, on the trunk or on thick roots. It forms large colonies in crevices in the bark and is always associated with ants. Oviparae are produced in October and November and an alate male has been seen from Arnhem in November. The few alatae seen or recorded were collected in August and October.

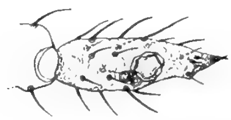
NOTES. The hairy ultimate rostral segment separates *kochiana* from other European *Cinara* but several North American species living on *Pinus*, including *Cinara pinata*, *C. piniradicis*, *C. puerca*, *C. tanneri* and *C. thatcheri* bear 20–50 accessory hairs on the ultimate rostral segment.

The oviparae of *C. kochiana* bear numerous rather indistinct pseudosensoria on the hind tibiae and the eggs in the abdomen are about 2 mm long and 0·9 mm wide.

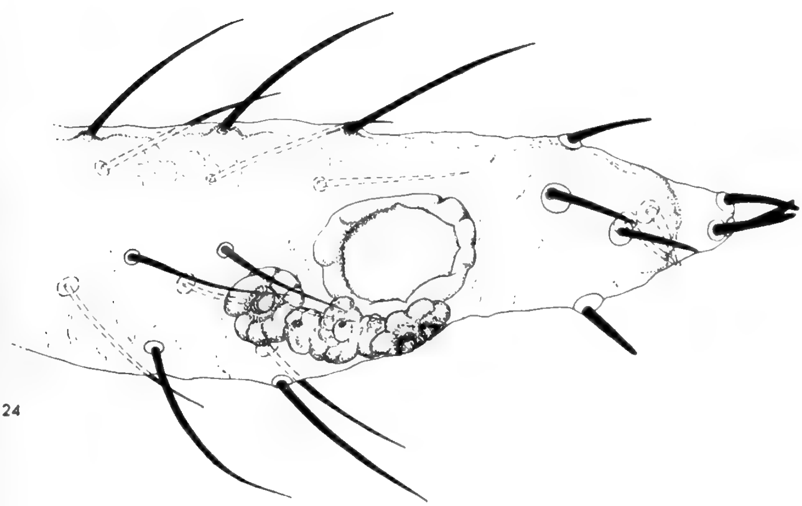
Braun (1938 : 482–491) found *Cinara kochiana* and called it *C. laricis* (Koch), although part at least of Koch's description does not fit *kochiana*. Subsequent authors proposing new names for *laricis* Koch nec Walker or Hartig, have been



22



23



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FIGS 22–25. *Cinara kochiana*, aptera vivipara. 22, third antennal segment, × 87. 23, sixth antennal segment, × 87. 24, processus terminalis, × 450. 25, fourth and fifth rostral segments, × 87.

accepting Braun's (1938) interpretation of *laricis* Koch. *Cinara kochi* Inouye, 1939 does not seem to be more than subspecifically distinct from *kochiana* according to Hille Ris Lambers (1956 : 246) and Inouye (1970 : 68–69). Börner (1939) lists *laricis cuneomaculata* as a synonym of *kochiana* but some of the proportions given by Del Guercio (hind tibia/hind tarsus 2 = 6·3; rostral 4 + 5/hind tarsus 2 = 0·74; rostral 4/hind tarsus 1 = 1·2), agree with *boerneri* and would exclude *kochiana*.

Cinara laricis (Walker)

Aphis laricis Walker, 1848 : 102–103, partim. [Lectotype BMNH, ENGLAND.]
? *Aphis tenuior* Walker, 1849 : xlix. [Possible type in BMNH, described without locality or date: see Doncaster, 1961 : 132.]
? *Lachnus laricis* Koch, 1856 : 241–243, partim. [No types, locality not given, presumably GERMANY.]
[*Lachnus pinicolus* Kaltenbach; Buckton, 1881 : 52–53, partim, the alate males recorded as 'winged viviparous females'.]
Lachnus laricis (Walker) Cholodkovsky, 1898 : 666–667; 1902 : 7; Schouteden, 1906 : 203–204; van der Goot, 1915 : 399–400.
Lachnus maculosus Cholodkovsky, 1899 : 469–470. [Types unknown. Described without locality, presumably near Leningrad.]
Lachniella nigrotuberculata Del Guercio, 1909 : 288, 306–309. [Types unknown. ITALY: Protolina, *Larix* sp., spring 1907, apterae and alatae viviparae.]
[? *Lachnus laricifex* (Fitch) Patch, 1912 : 164. Misidentification.]
Lachniella laricis (Walker) Jackson, 1919 : 164.
Dilachnus laricis (Walker) Swain, 1921 : 213; Wellenstein, 1930 : 749–750.
Lachnus muravensis Arnhart, 1927 : 471. [Possible types in BMNH; AUSTRIA.]
Panimerus laricis (Walker) Theobald, 1929 : 135–139, partim, the sexuales and some of the alatae viviparae are *C. boerneri*.
? *Cinara laricis* (Hartig) Hottes & Frison, 1931 : 155–156.
Cinara laricis (Walker) Hille Ris Lambers, 1931 : 3; Börner, 1932 : 569; Mordwilko, 1933 : 169; Braun, 1938 : 478; Pašek, 1954 : 253–256; Inouye, 1956 : 216; Doncaster, 1961 : 92–94; Szelegiewicz, 1962 : 83; Shaposhnikov, 1964 : 523.
Neochmosis laricis (Walker) Hille Ris Lambers, 1935 : 63.
Cinara laricis (Hartig) Inouye, 1962 : 147–151; 1970 : 65–66; Pintera, 1962 : 293–295.
Cinaria laricis (Walker) Börner, 1939 : 76; 1952 : 42; Heinze, 1962 : 163, 164.
Cinara doncasteri Pašek, 1953*c* : 222, 223; 1954 : 134, 141, 142. [Holotype, BMNH. SCOTLAND]; Heinze, 1962 : 159, 160; Pintera, 1962 : 292–293. **Syn. n.**

MATERIAL STUDIED.

Lectotype aptera vivipara, ENGLAND: London, Southgate, larch, 2.viii.1847, F. Walker slide no. 498.

One larva on the type-slide and another, 2.ix.1847, F. Walker 494. Surrey, Kew Gardens, *Larix decidua*, 26.x.1968, 2 oviparae, 1 alate male (*V.F.E.*). Berks, Mortimer, 'Larch/grass area', 2.vii.1959, 1 al., Forest Research Stn, Alice Holt colln. Herefordshire, Mortimer, *Larix eurolepis*, 14.ii.1959, 1 al. (*C. I. Carter*). Derbys, Smerrill Grange, *L. europaeus*, 22.vi.1946, 12 apt., 4 al.; Wensley, *L. europaeus*, 30.vi.1946, 2 al. (*J. P. Doncaster*). Westmorland, Windermere, Bishop's Wood, *Larix leptolassa*, 4.vi.1914, 3 al. (*Rymer Roberts*), F. V. Theobald colln.;

Farlwood, *L. leptolepis*, 13.v.1915, 1 al.; Ellerbeck, Kendal, oak, 26.vi.1914, 1 al. (*F. V. Theobald*). Cumberland, Dunnerdale, *L. europaeus*, 5.vii.1953, 5 apt. (*J. P. Doncaster*). SCOTLAND: '48–121' without further collection data, 1 al. (*F. Doubleday*), Walker colln. no. 676. Inverness, summit of Braeriach, 4000′, 28.vi.1932, 2 al. (*B. M. Hobby*) (types of *Cinara doncasteri*). Perth, Pitlochry, Faskally, *Larix decidua*, 21.v.1966, 2 apt. (*C. I. Carter*). Edinburgh, *L. decidua*, 22.x.1962, 1 ovipara; 'Bush nursery, *Larix* grafts', 22.x.1962, 4 alate males (*C. I. Carter*) (2 in Forest Res. Stn, Alice Holt colln.).

AUSTRIA: 'August 1927, *Lachnus muravensis*, Dr Arnhart', 5 apterae & larvae without further data. CZECHOSLOVAKIA: 'conifer', 1 al. without further data ex F. V. Theobald colln. Banska Stiavnika, *Larix decidua*, 13.vi.1950, 2 apt.; Bohemia, C. Krumlov, 13.viii.1951, 4 apt. (*V. Pašek*). GERMANY: Röth b. Berchtesgaden, *L. europea*, 23.vii.1952, 6 larvae (*H. Schmutterer* coll.), K. Heinze leg. Berlin, Dahlem, *L. europaea*, 1 apt., 1 larva, 8.vii.1950 (*W. Quednau* coll.), K. Heinze leg. ITALY: Zuel near Cortina, *Larix* sp., 30.vii.1969, 1 apt., 24 al. (*V.F.E.*). NETHERLANDS: Arnhem, *L. leptolepis*, November 1952, 2 oviparae (*J.T.B.O.N.*), D. Hille Ris Lambers colln.

HOST-PLANTS. *Larix decidua* (= *europaea* including *polonica*), *L. leptolepis* (= *kaempferi* Sarg.) and also recorded from *Larix laricina*, *L. sibirica* and *Pseudolarix amabilis* (= *kaempferi* Gord.).

DISTRIBUTION. Specimens have been seen from Austria, Czechoslovakia, England, Germany, Italy, Netherlands, Scotland and have also been recorded from Latvia (Rupais, 1961 : 14), Poland, Sweden, Switzerland (Werder, 1934 : 15), Ukraine, Mongolia (Szelegiewicz, 1963 : 113), Japan (Inouye, 1962 : 150) and with a query from Eastern Siberia (Grechkin, 1962 : 706). Records from America probably apply to other species.

BIOLOGY. Apterae viviparae can be collected from May until September and alatae viviparae in June and July. Single alatae have also been seen from February and May in Western Britain. Oviparae are produced in October and November. *Cinara laricis* lives under the old branches of *Larix* together with *Formica rufa* and when disturbed the alatae often do not fly but run towards the tree trunk, where they hide in crevices in the bark. It is a more northern or alpine species than *C. boerneri* although a few specimens of *C. laricis* have been collected with the more abundant *C. boerneri* in Southern Britain and a few specimens of *C. boerneri* have been collected among the more abundant *C. laricis* in the Dolomites near Cortina. Inouye (1962 : 147–151) describes both fundatrices and sexuales from Japan.

The eighth abdominal tergite of *Cinara laricis* usually bears 15–18 hairs dorsally but there may also be a ventro-lateral group of 1–5 hairs on either side bringing the total for the tergite up to as many as 25.

The copious honeydew crystalizes to form the 'Lärchenmanne' which is important to bee-keepers in central Europe.

Lachnus laricis Hartig, 1839 was not described in sufficient detail to make it certain that it should be placed in *Cinara*, let alone be applied to any particular species. Hottes & Frison (1931 : 155–156) place *laricis* Walker as a synonym of

laricis Hartig but from their key it seems likely that they did not have Walker's species. Hottes (1953 : 158) discusses the identity of *Cinara laricifex* (Fitch). Shinji (1941 : 244–248) had *C. laricicolus* (Matsumura) according to Inouye, 1962 : 155.

Cinara laricifoliae (Wilson, 1915) from *Larix occidentalis* in North America is similar to *C. laricis* but bears rather shorter hairs on the body and appendages and five sub-apical setae on the processus terminalis, according to a single aptera vivipara kindly provided by Mr G. A. Bradley. A single ovipara of *C. lyallii* Bradley, 1956 (leg. G. A. Bradley) from *Larix lyallii* in Alberta is similar to *C. laricifoliae* except for the smaller siphuncular cones and may only be a form of *C. laricifoliae*. *Cinara spiculosa* Bradley, 1956, from *Larix laricina* in Labrador, New Brunswick and Saskatchewan is also similar to *C. laricis* but is usually smaller and the body bears bifurcate dorsal hairs.

Cinara pectinatae (Nördlinger)

(Text-figs 26 & 27)

[*Aphis piceae* Panzer; Nördlinger, H., 1863 : 133–137. Misidentification.]
Aphis pectinatae Nördlinger, A., 1880 : 63. [No types. ? GERMANY.]
[*Lachnus piceae* (F.) Altum, 1880 : 352–353. Misidentification.]
Lachnus pichtae Mordwilko, 1895*a* : 84, 85, 94, 96, 103. [Types unknown. GERMANY: Böhmen, Carlsbad, *Abies pectinata*, 1893 (*M. Pawlowa*)]; 1895*b* : 104–105; Cholodkovsky, 1898 : 665; 1902 : 7; van der Goot, 1915 : 403–405.
Eulachnus macchiatii Del Guercio, 1909 : 316, 321–324. [Types unknown. ITALY: extremities of the twigs of *Abies pectinata*, *Pinus picea* or *Picea excelsa*, in September & October.]
Lachniella pichtae (Mordwilko) Jackson, 1919 : 164–165.
Panimerus pichtae (Mordwilko) Theobald, 1929 : 140–142.
Dilachnus pichtae (Mordwilko) Wellenstein, 1930 : 738, 748–749, 754.
Cinara pichtae (Mordwilko) Börner, 1932 : 568; Mordwilko, 1948 : 202.
Cinara pectinatae (Nördlinger) Braun, 1938 : 478, 485; Kloft, Kunkel & Ehrhardt, 1960 : 165–166; Szelegiewicz, 1962 : 84; Shaposhnikov, 1964 : 522.
Neochmosis pichtae (Mordwilko) Kloet & Hincks, 1945 : 72.
Buchneria pectinatae (Nördlinger) Börner, 1952 : 41; Pašek, 1954 : 263–266; Heinze, 1962 : 160.
Cinara (*Buchneria*) *pichtae* (Mordwilko) Bodenheimer & Swirski, 1957 : 246.

MATERIAL STUDIED.

ENGLAND: Surrey, Wisley, *Abies pindrow brevifolia*, 14.vi.1957, 8 apterae, 1 alata; 6.viii.1953, 2 apt.; 2.ix.1954, 8 apt. (*J. P. Doncaster*). Cambridge, University botanical gdns, *Abies veitchii*, 10–12.x.1950, 5 oviparae; 15.x.1954, 3 ovip., 27.ix.1954, 2 al. viviparae (*H. L. G. Stroyan* & colln.); 16.x.1950, 1 ovip.; 11.ix.1951, 7 apt. viviparae; 8.x.1951, 4 oviparae; *Abies numidica*, 3–24.x.1951, 1 alata vivipara, 1 ovipara & 2 alate males (*V.F.E.*). SCOTLAND: Morayshire, Rothes, *Abies pectinata*, 24–27.ix.1914, 1 apt. (*D. J. Jackson*).

CZECHOSLOVAKIA: Vysoka, *Abies alba*, 16.ix.1952, 2 apt. (*V. Pašek*). NETHERLANDS: Wageningen arboretum, *Abies pinsapo*, 21.vi.1954, 2 apt. (*D. Hille Ris Lambers & J. P. Doncaster*); *A. pectinata*, 1.x.1946, 1 alate male (*D.H.R.L.* & colln.); October 1966, 3 oviparae (*D. Doon* coll.), D.H.R.L. colln. POLAND: Lesn. Podgorze, G. Swietokrzyskia, *A. alba*, 15.vii.1962, 3 apt. (*J. Karpinski*), H. Szelegiewicz

colln. 1868. Zakopane, *A. alba*, 29.ix.1960, 3 oviparae (*R. Bielawski* coll.), H. Szelegiewicz colln. 1430. TURKEY: Borncua-Izmir, 'pine tree', 1948, 4 apt. (*Nihot-Iyriboz*). Bolu-Aladag ormani, 1500 m, *A. bornmuelleriana*, 4.vii.1964, 5 apt. (*H. Çanakçioğlu*).

HOST-PLANTS. *Abies alba* (= *pectinata*), *A. numidica*, *A. pindrow* subsp. *brevifolia*, *A. veitchii* and occasionally *A. bornmuelleriana* and *A. pinsapo*.

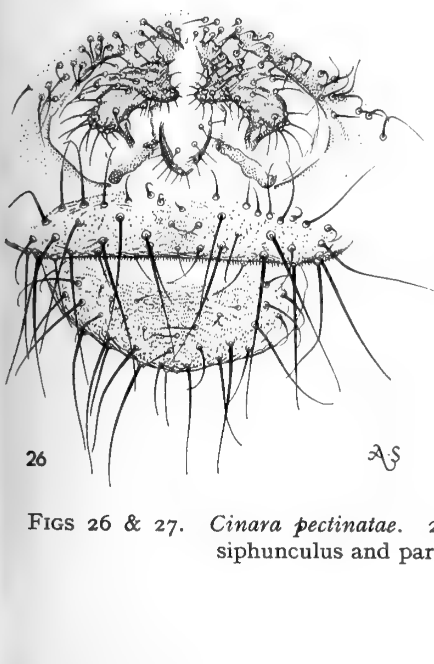
DISTRIBUTION. Specimens have been seen from Czechoslovakia, England, Netherlands, Poland, Scotland and Turkey and have also been recorded from Austria, Germany, Sweden, Yugoslavia and the Ukraine.

BIOLOGY. Apterae viviparae have only been seen in Britain during June, September and October. Oviparae and alate males have been collected in October Only four British alatae viviparae are known, one was taken in June, two in September and the other in early October. *C. pectinatae* seems not to have been collected in Britain during July or August. Leonhart (1940) and Fossel (1958) have given accounts of the biology. Gontarski (1941 : 326–327) and Zoebelein (1956 : 374) have investigated the honeydew.

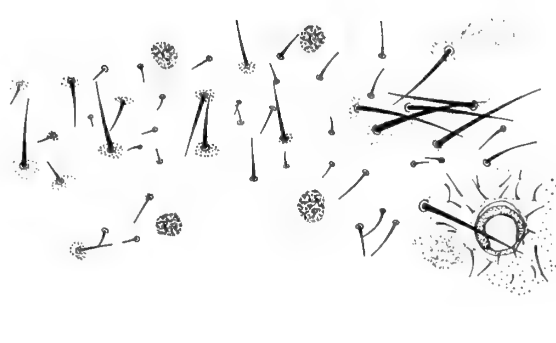
NOTES.

Type-species of *Buchneria* Börner, 1952

The alate males have unusually strongly pigmented abdominal sternites. Hottes & Essig (1954) compare *Cinara pectinatae* with *C. alacra* in its original description and *C. fornacula* Hottes is another similar American species. *Todolachnus abietis* (Matsumura, 1917) is closely related according to Hille Ris Lambers (1966*c* : 124).



26



27

FIGS 26 & 27. *Cinara pectinatae*. 26, ♂ genitalia, × 135. 27, aptera vivipara, right siphunculus and part of fifth abdominal tergite, × 87.

Cinara piceae (Panzer)

Aphis piceae Panzer, 1801, no. 22 (2 pp. + plate). [No types. GERMANY]; Zetterstedt, 1828 : 557–558; Kaltenbach, 1843 : 141–142; Walker, 1848 : 95–96.
[*Aphis laricis* Walker, 1848 : 102–103, partim (see Doncaster, 1961 : 93).]
Lachnus grossus Kaltenbach, 1846 : 174–175. [No types. Locality no stated, presumably GERMANY: near Aachen, on fichten, *Pinus abies*, May & June]; Mordwilko, 1895*a* : 96.
[*Lachnus piceae* (Walker) Buckton, 1880 : 58–59, mostly, but one specimen of *Tuberolachnus salignus* was included; Mordwilko, 1895*a* : 99; 1895*b* : 100; Cholodkovsky, 1898 : 655–656; 1899 : 468; Schouteden, 1906 : 205–207; van der Goot, 1915 : 401–402; Mordwilko, 1929 : 27.]
[*Lachnus longipes* (Dufour) Buckton, 1881 : 59–61, partim, aptera only, the alatae are *Tuberolachnus salignus*. Misidentification.]
[*Panimerus vanduzei* (Swain) Theobald, 1929 : 154–156, partim (the Irish specimens are genuine *vanduzei* = *abieticola*). Misidentification.]
Dilachnus piceae (Walker) Wellenstein, 1930 : 738, 742.
Dilachnus grossus (Kaltenbach) Wellenstein, 1930 : 747, 750, 757.
Cinara piceae (Panzer) Börner, 1932 : 569–570; Braun, 1932 : 479, 491; Wahlgren, 1939 : 2; Mordwilko, 1948 : 201; Szelegiewicz, 1962 : 84–85.
[*Cinara vanduzei* (Swain) Börner, 1932 : 570; Braun, 1932 : 479; Onouye, 1937 : 105. Misidentification.]
Cinara piceae (Walker) Mordwilko, 1933 : 159.
Neochmosis piceae (Panzer) Hille Ris Lambers, 1935 : 63.
[*Neochmosis vanduzei* (Swain) Kloet & Hincks, 1945 : 72. Misidentification.]
Cinaropsis (*Mecinaria*) *piceae* (Panzer) Börner, 1949 : 59; 1952 : 44.
Cinaria (*Mecinaria*) *piceae* (Panzer) Pašek, 1954 : 198–200, 201.
Cinara (*Mecinaria*) *grossa* (Kaltenbach) Aizenberg, 1956 : 131–139.
Mecinaria piceae (Panzer) Heinze, 1962 : 166, 167, 168.
Cinara grossa (Kaltenbach) Shaposhnikov, 1964 : 521; Pintera, 1966 : 314–316; Inouye, 1970 : 69.
Cinara piceae var. *pasheki* Szelegiewicz, 1962 : 85. [Types. Polish Academy of Science, Institute of Zoology: CZECHOSLOVAKIA & POLAND.]

MATERIAL STUDIED.

ENGLAND: London, South Kensington, flying over roof of BMNH, 6.v.1961, 1 alata (*J. F. Perkins*). Grounds of Buckingham Palace, light trap, 25–26.vi.1964, 1 al. (*J. D. Bradley*). Kennington, *Picea pectinata*, June 1901, 1 aptera, 1 al. (*F. V. Theobald*). Hants, Alresford, spruce, 28.xii (prior to 1881), 9 eggs (*J. Anderson*), Buckton colln. 339 & 340. Kent, Wye, *Picea excelsa*, 7.vi.1911, 1 al. (*F.V.T.*). Surrey, Wisley, *Picea sitchensis*, 16.v.1938, 5 fundatrices; 2.vii.1938, 3 alatoid nymphs (*F. Fox-Wilson*). Wrecclesham, *P. excelsa*, 10.vi.1963, 1 al. (*C. I. Carter*). Kew Gardens, oriental spruce, August 1926, 2 apt. (*E. V. Laing*). Banstead, *Picea* sp., October 1954, 1 apt. vivipara, 3 oviparae (*B. M. Gerard*). Bucks, Slough, spruce, October 1963, 1 apt. vivip., 2 oviparae (*Royal Horticultural Society*). High Wycombe, October 1968, 3 oviparae (*J. Perry*). Berks, Reading, 15.v.1961, 5 larvae, (*Reading Museum*). Newbury, *Picea sitchensis*, 9.vi.1952, 7 al. (*W. D. Empson*). Oxon, Henley-on-Thames, *P. pungens* var. *glauca*, 24.iv.1961, 20 fundatrices (*T. Barnard*), via A. C. Jermy. Gloucs, Cowley Manor, June 1959, 1 al. (*R. S. George*). Devon, Scots pine, June 1937, 1 apt., 3 al. & alatoid nymph (*L. N. Staniland*). Dorset, Broadstone, *P. spinulosa*, 18.ix.1952, 7 apt. (*C. Carter*). Derbys, Alport,

Hope Forest, *P. sitchensis*, 19.vii.1965, 1 al. (*C. I. Carter*). Cambridge, *Picea* sp., 26.x.1950, 47 oviparae (*H. L. G. Stroyan*). Cumberland, Penrith, spruce, 1.x.1913, 1 apt. vivip., 1 ovipara (*F. R. Markham*). Keswick, silver fir, 20.vi.1961, 1 al. (*P. Becker*). Westmorland, without further data, 3 al. & 2 alatoid nymphs (*G. B. Piffard*). Yorks, Allerston Forest, *P. excelsa*, 13.vii.1949, 2 al. (*H. S. Hanson*). Also in the BMNH collection are 9 alatae without data on Walker slides 638–646, 2 alatae from spruce collected by *G. Saunders* on G. B. Buckton slide 336 and 1 ovipara, 29.xi.—, Buckton slide 341, on which Buckton's interpretation of *longipes* Dufour is based. SCOTLAND: Lochgoilhead, July 1922, 1 al. (*A. Cuthbertson*). Novar, spruce, 31.x.1923, 1 ovipara (*A. S. Watt*). S. Queensferry, Hopetown, sitka spruce, 28.ix.1931, 1 apt. vivip., 4 oviparae (*G. C. R. McLaggan*). Aberdeen, Dee Valley, spruce, 29.vi.1965, 1 al. (*M. Crooke*). EIRE: Dublin, *Picea sitchensis*, October 1959, 4 oviparae.

AUSTRIA: Saalbaach, at light, 29.vii.1962, 1 al.; 'Yellow Composite Stars', 30.vii.1962, 2 al. (*M.C.*); Spider's web, 30.vii.1962, 1 al. (*M. Clifton*). Gross Glochner Pass, on pine fence, 24.vii.1967, 6 al. (*H. J. Banks*). CZECHOSLOVAKIA: without further data, 1 al., F. V. Theobald colln. Banska Stiavnika, *Picea excelsa*, 7.v.1950, 1 fundatrix; *P. orientalis*, 13.v.1950, 1 fundatrix; 23.viii.1950, 3 apt. Gelnica, *P. excelsa*, 18.vi.1952, 1 apt. Zilina, *P. excelsa*, 10.viii.1949, 2 apt. (*V. Pašek*). One alata collected prior to 1933 by *D. Aubertin*, without further data. FRANCE: Savoy, Glacier des Evettes, 2600 m, July 1929, 2 al. (*P. Vayssière*). ITALY: Dolomites, Mt Sella, 8–9000′, 8.viii.1962, 7 al. (*O. W. Richards*). NETHERLANDS: Bennekom, *P. excelsa*, 25.ix.1946, 3 apt. viviparae, 1 ovipara; Ede, *P. sitchensis*, 28.v.1957, 1 fundatrix or second generation aptera (*D. Hille Ris Lambers* & colln.).

HOST-PLANTS. *Picea* species, mostly of the *Eupicea* group; seen from *Picea abies* (= *excelsa*, *rubra* A. Dietr. nec Du Roi) including the variety *fennica* and more rarely *P. glauca* (= *alba*, *canadensis*), *P. orientalis* and also recorded from *Picea obovata*, *P. pungens* and *P. schrenkiana* (= *tianschanica*). Also seen from *Picea sitchensis* of the *Cascita* group and *P. spinulosa* of the *Omorika* group.

DISTRIBUTION. Specimens have been seen from Austria, Czechoslovakia, Eire, England, France, Italy, Netherlands, Scotland and are also recorded from Belgium ((Schouteden, 1906 : 203), Finland, Germany, Norway, Poland, Sweden, Switzerland, U.S.S.R., Estonia, Latvia (Zirnits, 1927 : 251), Ukraine, Kazakhstan and Japan (Inouye, 1970 : 69). The records from Spitzbergen are based on wrongly identified specimens of *C. abieticola* (see p. 125).

BIOLOGY. In Southern England adult fundatrices are present by late April or early May and apterae viviparae have been collected in June and from August to October: alatae viviparae occur in May and June. Alatae are more abundant than apterae during June. In Derbyshire, Yorkshire and Scotland alatae occur during June and July. Oviparae occur in September and are the commonest form found during October. Males have not been seen. According to Pintera (1966 : 316) the eggs hatch rather late and the colonies feed first on the older branches and trunk and move down to the roots in the summer. Attended by ants, especially

Formica and *Camponotus* spp. Inouye (1970 : 69) gives an account of the biology in Japan. *Cinara piceae* is a large aphid which sometimes occurs in large numbers in parks and gardens during spring and early summer and in the autumn. It may cause damage to the twigs and Nuorteva (1957 : 35–36) has investigated the saliva. Gontarski (1941 : 321–322) and Zoebelin (1956 : 373–374) have studied the honeydew.

NOTES.

Type-species of *Mecinaria*, Börner, 1949

From Panzer's (1801) account of *Aphis piceae*, 'Die Blattlaus auf der Weistanne' it seems that he had seen both *C. piceae* (= *grossa*) from *Picea* and *C. abieticola* from *Abies*, and considered them to be the same species. He coined his scientific name from the host of the spruce-feeding aphid and his common name from the host plant of the fir-feeding aphid. His description and illustration however applies to the *Picea*-feeding species, the reddish hind tibiae with dark apices being typical for the *Picea*-feeding aphid and excluding *C. abieticola*, which has entirely dark hind tibiae. Panzer used the name *Pinus picea* for spruce, *Picea abies* (= *excelsa*) and used the name *Pinus Abies* for fir, *Abies alba* (= *pectinata*). Kaltenbach used *Pinus Abies* for *Picea abies*, spruce. The use of the name *Picea abies* for both the common spruce and a widely planted fir has contributed to the confusion in aphid literature.

The *Picea*-feeding aphid *Cinara piceae* is distinguished from the *Abies*- and *Cedrus*-feeding species *C. abieticola* by 10 of the 31 characters given in Table 3 (page 173) but *C. piceae* is similar in many respects to the North American *C. curvipes* (Patch) which also lives on *Abies* and *Cedrus*.

The oviparae resemble the viviparae in the absence of pseudosensoria on the hind tibiae. *Cinara piceae* is also unusual in that while oviparae are common, males are unknown. The pseudosensoria on the hind tibiae of most oviparae are thought to emit pheromones (Pettersson, 1970 : 63–73). The fundatrices also resemble the later generations of apterae viviparae and are not more densely hairy as they are in other species of *Cinara*. The unusual similarity between fundatrices and apterae viviparae may indicate that *Picea* has only recently been acquired as a host plant. *Cinara piceae* is very different from the other European species of *Cinara* feeding on *Picea*. The fundatrices of *C. piceae* may be recognized by the processus terminalis being only 9–22% of the length of the sixth antennal segment and the base of the sixth antennal segment is 0·55–0·66 times as long as the fourth rostral segment, while in the later generations of apterae viviparae the processus terminalis is 18–28% of the length of the sixth antennal segment and the base of the sixth antennal segment is 0·42–0·54 as long as the fourth rostral segment.

Cinara pilicornis (Hartig)

(Text-figs 28–31)

[? *Aphis pineti* F.; Zetterstedt, 1828 : 558–559 (see Wahlgren, 1939 : 2). Misidentification.]

Aphis pilicornis Hartig, 1841 : 369. [Types unknown. Locality not stated, presumably GERMANY.]

? *Lachnus pinicola* Kaltenbach, 1843 : 154–155. [Types unknown. Locality not stated,

presumably GERMANY: on spruce, April to August]; Schouteden, 1906 : 207.

Aphis abietis Walker, 1848 : 100. [Lectotype, BMNH, ENGLAND.]

Lachnus hyalinus Koch, 1856 : 238–240. [No types. Locality not stated, presumably GERMANY: on spruce, June, apterae and alatae]; Mordwilko, 1895*b* : 106–107; Cholodkovsky, 1896*a* : 146–148; 1898 : 663–665; ? Patch, 1912 : 165–167; van der Goot, 1915 : 394–396.

Lachnus macrocephalus Buckton, 1881 : 48–50. [Type, BMNH: ENGLAND.]

Lachnus flavus Mordwilko, 1895*a* : 94, 101–102; 1895*b* : 133–134. [Types unknown. Without locality, presumably POLAND]; Cholodkovsky, 1898 : 659.

[? ***Lachnus pinicola*** Kaltenbach; Mordwilko, 1895*a* : 100–101. Misidentification.]

? ***Lachnus piceicolus*** Cholodkovsky, 1896*a* : 146, 148–150. [Types unknown. U.S.S.R., near Leningrad & Estonia, on spruce, 1895 & 1896]; 1898 : 402–403; 659–662; 1902 : 7.

[? ***Lachnus pinicolus*** Kaltenbach; Del Guercio, 1900 : 108. Misidentification.]

Lachniella hyalina (Koch) Del Guercio, 1909 : 303–305.

Lachnus abietis (Walker) Wilson & Vickery, 1918 : 27.

[? ***Lachniella pinicola*** (Kaltenbach) Jackson, 1919 : 165. Misidentification.]

Dilachnus hyalinus (Koch) Swain, 1919 : 213.

[***Panimerus pinicola*** (Kaltenbach) Theobald, 1929 : 129–131. Misidentification.]

Panimerus pinihabitans (Mordwilko) Theobald, 1929 : 132–135. Misidentification.]

Panimerus hyalinus (Koch) Theobald, 1929 : 152–153.

Neochmosis abietis (Walker) Theobald, 1929 : 352–354.

[? ***Cinara pinicola*** (Kaltenbach) Hottes & Frison, 1931 : 156–157. Misidentification.]

[***Cinara pinicola*** (Kaltenbach); Börner, 1932 : 568; Braun, 482. Misidentification.]

? ***Cinara nopporensis*** Inouye, 1937 : 100–137. [Types in Entomological Institute of Hokkaido Imperial University. JAPAN: Hokkaido, *Picea glehni*, May, June & September, 1936.]

[***Cinaropsis pinicola*** (Kaltenbach) Börner, 1939 : 76. Misidentification.]

? ***Cinara hyalina*** (Koch) Blanchard, 1939 : 864–865.

? ***Cinara piceicola*** (Cholodkovsky) Palmer, 1945 : 447–448; 1952 : 39–40 (see Hottes, 1952 : 39–40).

Neochmosis hyalinus (Koch) Kloet & Hincks, 1945 : 72.

Cinaropsis pilicornis (Hartig) Börner, 1952 : 43; Heinze, 1962 : 170–171.

Cinara (Cinaropsis) pilicornis (Hartig) Pašek, 1954 : 207–210; Doncaster, 1961 : 13–15; Inouye, 1970 : 80–81.

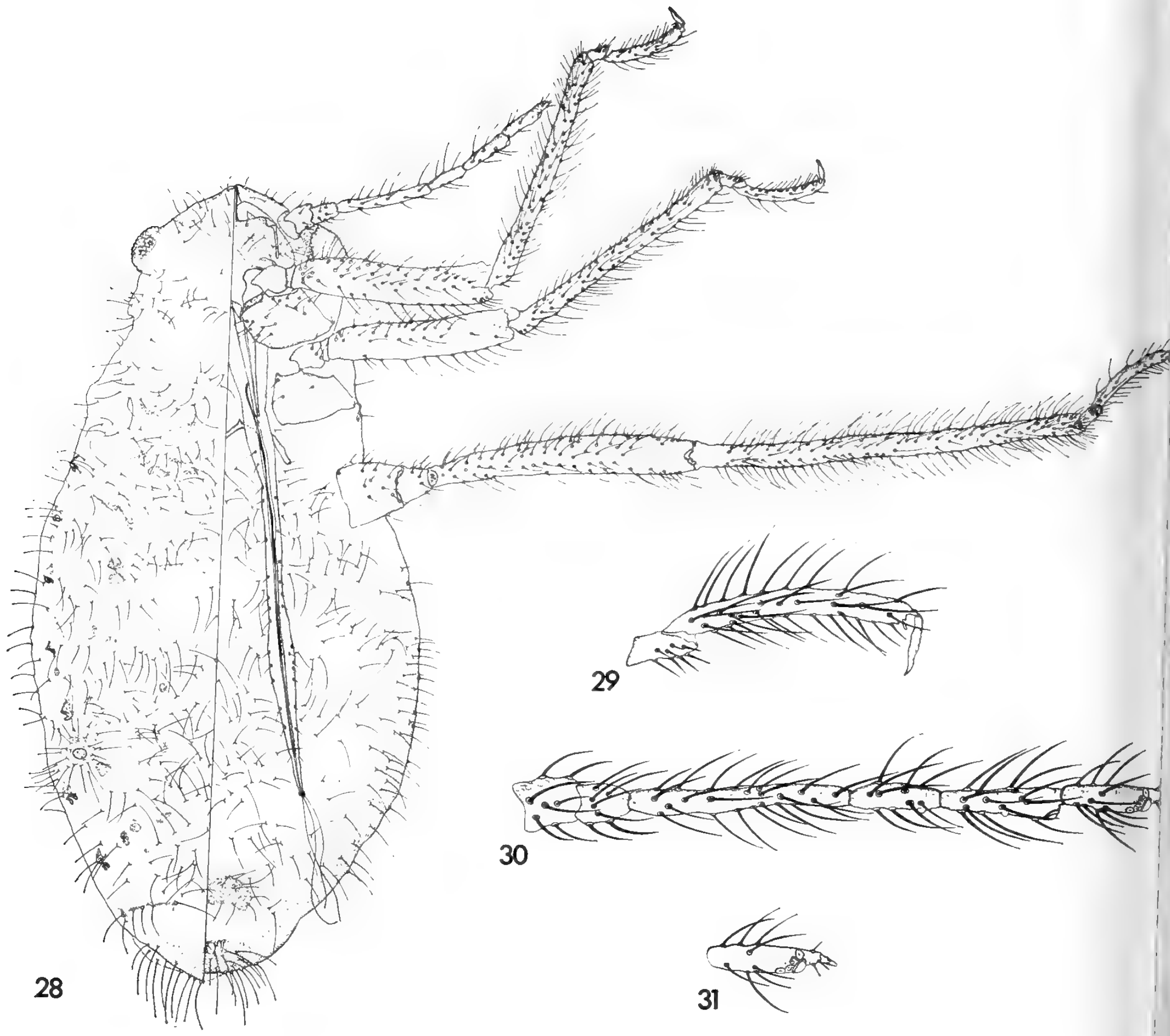
Cinara pilicornis (Hartig) Hottes, 1955 : 76–77; Kloft, Kunkel & Erhardt, 1960 : 166; Szelegiewicz, 1962 : 25; Shaposhnikov, 1964 : 522; Pintera, 1966 : 304–307.

[***Cinara (Cinaropsis) pinicola*** (Kaltenbach) Çanakçioğlu, 1966 : 139. Misidentification.]

MATERIAL STUDIED.

ENGLAND: Francis Walker slides 663–666, each labelled only '*pini L.*' and each bearing a single alata vivipara. F. Walker slide no. 4 labelled '*abietis*' only and bearing a single alate male. Single alata vivipara labelled only '20.vi.1949 (*Hanson*). London, Southgate, spruce fir, 3.vii.1847, 1 alata vivipara, 1 alate male (*F. Walker* 7 & 7a); 24.vii.1847, 2 al. ♂♂ (*F.W.* 1167); 16.viii.1847, 2 oviparae (*F. Walker* 370). Surrey, Wisley, young spruce, 1.vii.1958, 3 alatae viviparae; spruce, May 1957, 3 al. (*P. Becker*). *Picea sitchensis*, 14.vi.1957, 5 al. (*J. P. Doncaster*); '*Abies pindrow brevifolia*', 14.vi.1957, 1 al. (*J.P.D.*). Farnham Forest Res. Stn, *Picea sitchensis*, 29.v.1957, 1 al. (*J. H. Styles*). Kew Gardens, *P. likiangensis*, 21.v.1960, 5 apterae viviparae; 16.vi.1961, 3 al.; *P. asperata*, 11.v.1961, 4 apt.; *P. breweriana*, 16.vi.1961, 2 al.; *P. obovata*, 16.vi.1961, 2 apt., 3 al. (*V.F.E.*); *Picea excelsa*, 18.vi.1920, 1 al. (*F. Laing*). Fernhurst, *P. sitchensis*, 11.vii.1967, 1 apt., 1 al.; Middlesex, Moor Park, *Picea*, 15.vii.1962, 1 al. (*V.F.E.*). Herts, Whetstone, m/v light, 5.vi.1961, 1 al.

(*P. H. Ward*). Harpenden, Rothamsted, *P. excelsa*, 16.vi.1920, 1 apt., 2 al. (*F. V. Theobald*). Beds, Streatley, 'scots pine', 9.vi.1913, 9 apt. (*F.V.T.*). Bucks, Slough, spruce, 1937, 1 apt., 3 al. (*A. Downes*). Berks, Reading, *Picea*, 7.vi.1950, 2 al. (*V.F.E.*). Kingsmere, *P. excelsa*, 12.vi.1949, 5 apt., 8 al. (*V.F.E. & A. Mills*).



FIGS 28–31. *Cinara pilicornis*, aptera vivipara. 28, × 30. 29, hind tarsus, × 87. 30, antenna, × 87. 31, sixth antennal segment, × 87.

Hants, Bramshot, '*Abies*' *excelsa*, 26.vii.[prior to 1881], 1 ovipara, 2 alate males (*G. B. Buckton* (slide 274, type-series of *macrocephalus*)). Headley, *Picea excelsa*, 29.v.1950, 4 apt. (*V.F.E.*). Sussex, Ashdown Forest, *Picea*, 5.vii.1961, 1 al. (*H. K. Airy Shaw*). Kent, Bromley, *Picea abies*, 5.vii.1965, 2 al. (*H. C. Dale*). Wye, spruce, 5.vii.1913, immature including 1 alatoid nymph; 2.vi.1914, 5 al.; 10.viii.1920, 2 al. (*F.V.T.*). Vagrant alata, 14.vii.1927 (*F.V.T.*). Cambridge, University botanic gdn, *Picea likiangensis*, 12.vi.1952, 10 al.; *P. asperata*, 11.ix.1952, 1 apt. vivipara, 1 ovipara (*V.F.E.*). *Picea* sp., 26.x.1950, 3 oviparae (*H. L. G. Stroyan* & colln.). Staffs, Burton-on-Trent, *Picea sitchensis* (as *Abies menziesii*), 5.vii.1847, 1 al. (*F. Walker*, 369). Cumberland, Great Salkeld, spruce, 2–3.vi.1911, 1 apt., 4 al.; 4.v.1913, immature; 26.vi.1914, 1 apt., 2 al. Penrith, spruce, 3.vi.1911, 6 al. (*F. V. Theobald*). Ennerdale, *P. sitchensis*, 3.vii.1945, 2 al. (*H. S. Hanson*). SCOTLAND: Aberdeen, Seaton's nursery, 'on broom', July 1926, 5 apterae viviparae, 2 of them ovipariform and 2 alatae viviparae (*E. V. Laing*). Sutherland, R. Shin, 2 m. west of Inveran, *Picea abies*, 9.vii.1961, 3 al. (*J. P. Doncaster*). Caithness, Rumster Forest, *P. sitchensis*, 4 apt., 1 alatoid nymph (*C. I. Carter*). WALES: Anglesey, Wern Forest, *Picea*, 4.vi.1963, 6 apt. (*V.F.E.*). IRELAND: Rathdrum, *Pinus sylvestris*, 22.vi.1912, 1 al.; spruce, 22.v.1913, 2 apt. (*F. V. Theobald*).

AUSTRIA: Gross Glochner Pass, pine fence, 24.vii.1967, 1 al. (*H. J. Banks*). Carinthia, Ossiach, *Picea*, 8.viii.1966, 1 apt. (*V.F.E.*). CZECHOSLOVAKIA: Gelnica, *P. excelsa*, 17.vi.1952, 3 apt.; Palana Mountain, *P. excelsa*, 22.vi.1951, 2 apt., 1 al. (*V. Pašek*). GERMANY: Zucht von Schleipitz, *P. excelsa*, 5.xi.1940, 1 ovipara (*K. Heinze*). Gratrath, *P. excelsa*, 16.vii.1952, 1 apt. (*H. Schmutterer* coll., K. Heinze leg.). Rottbitze nr Bonn, *Picea* seedling, 18.viii.1966, 9 apt. (*V.F.E.*). NORWAY: Espeland, Fana, trapped, 28.vi.1954, 1 al. (*H. Tambs-Lyche*). SWEDEN: Trey-töa, *Picea pungens*, 16.vii.1949, 1 al. (*F. Ossiannilsson*). TURKEY: Istanbul, Bahcekoy, 110 m, *P. abies*, 5.vi.1964, 8 apt., 8 al.; Artvim, Kurukürun, 1940 m, *P. orientalis*, 8.viii.1964, 4 apt., 1 al. (*H. Çanakçioğlu*).

AUSTRALIA: N.S.W., Bilpin, *Picea abies*, 10.viii.1967, 1 apt., 1 al. (*M. Casimir* coll.), M. Carver leg.

HOST-PLANTS. *Picea* species of the *Eupicea* and *Cascita* groups; specimens have been seen from *Picea abies* (= *excelsa*, *rubra* A. Dietr. nec Du Roi), *P. asperata*, *P. obovata*, *P. orientalis* and are also recorded from *P. glauca* (= *alba*, *canadensis*), *P. koyamai* (= *koraiensis*), *P. pungens*, *P. rubens* (= *rubra* Du Roi), *P. schrenkiana* (= *tianschanica*) of the *Eupicea* group; seen from *P. likiangensis*, *P. sitchensis* and also recorded from *P. engelmanii* of the Cascita group and one sample has also been seen from *Picea breweriana* of the *Omorika* group.

DISTRIBUTION. Specimens have been seen from Austria, Czechoslovakia, England, Germany, Ireland, Norway, Scotland, Sweden, Turkey, Wales and New South Wales, Australia. *Cinara pilicornis* is also recorded from France, Hungary, Iceland, Japan, Netherlands, Poland, Roumania, Yugoslavia, U.S.S.R., Latvia, Lithuania, Estonia, Georgia, Ukraine, Khazakhstan, Caucasus and is said to have been introduced to America (Patch, 1912; Burnham, 1938; Archibald, 1958 : 106). American specimens resembling *pilicornis* seen by the present author appear to belong to

related American species such as *braggii*. Blanchard's (1939 : 864–865) description of the single alata he collected on *Abies* and identified with *C. hyalina* fits *C. pilicornis* but as there are several similar North American species, the Argentinian record cannot be accepted with certainty. Gomez Menor (1962 : 382–386) applies the name *pilicornis* to what appears to be a short-haired member of the *pini* group. Gomez Menor's (1934 : 1372) record of *Cinara pinicola* from Dominica was probably not based on *pilicornis* either.

BIOLOGY. Apterae viviparae can be collected from May to July and one specimen has been seen from September. Alatae viviparae occur from May to August and sexuales from July to September. A much higher proportion of viviparae are winged than in other British *Cinara* and the sexuales start to occur earlier in the year than usual in *Cinara*. Cholodkovsky (1895 : 659–662) gives an account of the biology of what he calls *Lachnus piceicola* near Leningrad and in Estonia, saying that sexuales occur from mid June onwards. Pintera (1966 : 304) lists papers dealing with the biology of *C. pilicornis* which in botanical gardens is only casually attended by *Lasius niger*. Börner & Franz (1956 : 308) attribute the wide geographical distribution of *Cinara pilicornis* to its comparative independence of ants. Other authors state that there is a close association with ants. These discrepancies may be due to confusion with *Cinara stroyani* (= *piceicola* auct.). Kurir (1964 : 139–157) gives an account of an outbreak in Austria of *C. pilicornis* and of its natural enemies.

Cinara pinea (Mordwilko)

(Text-figs 32–33)

[? *Aphis pini* L., 1758 : 453 partim.]

? *Lachnus pineti* Hartig, 1839 : 645.

[? *Aphis pilosa* Zetterstedt, 1840 : 311 (see Wahlgren, 1939 : 2–3).]

[*Aphis pini* L., Walker, 1848 : 96–98.]

[*Aphis laricis* Walker, 1848 : 102–103 partim, the alatae and perhaps var. 3 (see Doncaster, 1961 : 93).]

[*Lachnus pineti* (F.) Koch, 1855 : 230–232; Cholodkovsky, 1892 : 74.]

[*Lachnus pini* (L.); Buckton, 1881 : 50–51; Weed, 1890 : 118.]

Lachnus pineus Mordwilko, 1895*a* : 75, 76, 77, 80, 82, 94, 100. [Types unknown. Without locality, presumably POLAND.] 1895*b* : 102, 126–130.

[*Lachnus pineti* (Koch); Cholodkovsky, 1898 : 635–638; Schouteden, 1906 : 207; van der Goot, 1915 : 405–408.]

[*Eulachnus pineti* (F.) Del Guercio, 1909 : 334–337.]

[? *Lachnus pini* (L.); Weed, 1890 : 118; Patch, 1912 : 168–169.]

[? *Lachniella pini* (L.) Jackson, 1919 : 165.]

[*Dilachnus taeniatus* (Koch) Swain, 1921 : 228–229. Misidentification.]

[*Panimerus pini* (L.) Theobald, 1929 : 145–147.]

[*Dilachnus pineti* (Koch) Wellenstein, 1930 : 751–752.]

(*Cinara pini* (L.) Hottes & Frison, 1931 : 156; Börner, 1939 : 76; 1952 : 41; Pašek, 1954 : 134–138.]

Cinara pinea (Mordwilko) Börner, 1932 : 569; Mordwilko, 1933 : 159; Braun, 1938 : 478, 492; Knechtel & Manolache, 1943 : 217–219; Palmer, 1952 : 40; Heinze, 1962 : 158–159; Szelegiewicz, 1962 : 85–86; Shaposhnikov, 1964 : 523; Pintera, 1966 : 285–286.

[? *Cinara pinicola* (Kaltenbach); Silvestri, 1934 : 420–421. Misidentification.]

Cinara (*Cinarella*) *pinea* (Mordwilko) Hille Ris Lambers, 1948 : 275.

MATERIAL STUDIED.

ENGLAND: without further data, 2 apterae, 2 alatae, *F. Walker* 659–662. Kent, Hothfield, *Pinus sylvestris*, July 1925, 3 apt.; August 1925, 1 apt. Wye, spruce, 27.v.1913, 7 apt. & 1 alatoid nymph (*F. V. Theobald*). [The correct data for this sample is probably '*Pinus sylvestris*, 5.v.1913': see data for *Cinara costata* from Wye, May 1913.] Brookland, pine, 14.v.1961, 2 apt., 1 al. (*G. M. Day*). Keston, *P. sylvestris*, 11.v.1965, 6 apt.; Hosey Hill, *P. sylvestris*, 6.vii.1964, 2 apt. (*H. C. Dale*). London, Southgate, *P. sylvestris*, 2–5.vi.1847, 3 apt., 1 al.; 25–26.vi.1847, 1 apt., 1 al.; 3.vii.1947, 1 apt., 1 al.; 25.viii.1847, 1 apt., *F. Walker* 668–673. Surrey, *P. sylvestris*, 26.vii.1927, 2 apt.; Woking, *Pinus*, 20.v.1912, 6 apt., many alatoid nymphs; *P. sylvestris*, 19.iv.1913, 3 apt.; 6–20.v.1913, 6 apt., 2 al. & 1 alatoid nymph; 19.vi.1913, 1 apt. (*F. V. Theobald*). Woking, *P. sylvestris*, 15.v.1920, 2 apt., 1 al. (*F. Laing*). Send, *P. sylvestris*, 9.vii.1956, 1 al. (*D. J. Williams*). Wisley Common, ? *Pinus*, 3.v.1965, 2 apt. (*P. S. Broomfield*); pine, 23.v.1965, 1 apt. (*A. Stubbs*). Weybridge, under pine with ant, 1 apt. (*F. V. Theobald*). Kew Gardens, *Picea*

FIGS 32 & 33. *Cinara pinea*, right siphunculus and part of fifth abdominal tergite, × 87. 32, alata. 33, aptera.

excelsa, 18.vi.1920, 1 al. (*F. Laing*); rose bushes, 1–26.vi.1923, 2 al. (*C. L. Withycombe*). Oxshott, pine, 26.vi.1923, 1 al., 13.vi.1926, 2 apt. (*O. W. Richards*). Wisley, R.H.S. gdns, *P. sylvestris*, 14.vi.1957, 1 apt., 4 al. (*J. P. Doncaster*); 22.vi.1961, 1 al. (*P. Becker*). Byfleet, Sheerwater Woods, *P. sylvestris*, 22.iv.1949, 3 fundatrices (*H. L. G. Stroyan* & colln.). Berks, Reading, *P. sylvestris*, 18.vi.1948, 1 apt.; 30.v.1949, 2 apt. (*V.F.E.*). Silwood Park, 40′ suction trap, 4.x.1968, 1 alate male (*Forestry Commission* colln.). Hants, Liphook, *P. sylvestris*, 26.v.1918, 1 al. (*W. C. Crawley*). Alice Holt Lodge, *P. sylvestris*, 24.v.1966, 2 apt., 2 al. (*C. I. Carter*); 14.vi.1967, 2 apt., 2 al. (*H. C. Dale*). New Forest, nr Brook, 10.vii.1962, 4 apt., 1 al. (*J. Grant, G. Day, P. H. Ward*). Herts, Ayot St Lawrence, *Pinus contorta*, 25.v.1946, 4 apt., 2 al. (*J.P.D.*). Whetstone, m/v light, 3–25.vi.1961, 2 al. (*P. H. Ward*). Cambridge, University Botanic gdn, *P. sylvestris*, 10.x–17.xi.1950, 3 oviparae; 21.v.1952, 3 apt.; 20.viii.1951, 1 apt. (*V.F.E.*). Suffolk, Barton Mills, *P. sylvestris*, 24.iii.1948, 6 fundatrices (*H. L. G. Stroyan* & colln.). Walberswick, *P. sylvestris*, 24.viii.1952, 3 apt. (*J.P.D.*). Brooms Barn, nr Bury St Edmunds, 40′ trap, 1.vii.1969 (*N. R. Maslen*, Forestry Commission colln.). Derbys., Wensley, *P. sylvestris*, 28.vi.1946, 7 apt. (*J.P.D.*). Staffs, Cannock, corsican pine, June 1961, 1 apt.; Salop, Whixall Moss, *P. sylvestris*, 28.vi.1969, 1 apt. (*B. R. Pitkin*). Harper Adams, trapped, 3.x.1958, 1 al. (*J.P.D.*). Cumberland, Ennerdale, *P. sylvestris*, 3.vii.1945, 6 apt., 1 al. (*M. S. Hanson*). Eskdale, *P. sylvestris*, 4.vii.1953, 4 apt., 1 al. (*J.P.D.*). Westmorland, Windermere, *P. sylvestris*, 15.vi.1912, 2 apt. (*F.V.T.*). SCOTLAND: *P. sylvestris*, August 1920, 3 apt. (*McDougall & F.V.T.*). Kincardineshire, nr Aberdeen, *P. sylvestris*, July/August 1919, 2 apt., 1 al. (*F. Laing*). Inverness, *P. sylvestris*, 12.viii.1948, 2 apt., 1 al. (*H. S. Hanson*). Perth, Trossachs, juniper, 23.vi.1932, 1 al. (*W. H. T. Tams*). Angus, Glen Doll Lodge, *Pinus ? contorta*, 28.vi.1959, 6 apt. (*J. P. Doncaster*). Aberdeenshire, Dinet, *Pinus*, 24.v.1966, 1 apt., 1 al. (*L. A. Mound*). Fife, Dundee, 40′ trap, 17.ix–14.x.1968, 2 alate males (*Forestry Commission* colln.).

CZECHOSLOVAKIA: Jakubov, *Pinus sylvestris*, 26.iv.1952, 2 fundatrices; 18.v.1950, 3 apt. (*V. Pašek*). Kurdejov, *P. sylvestris*, 28.v.1964, 1 al.; Sklene, *P. sylvestris*, 30.v.1964, 1 apt., 1 al.; Kostelni Llota, *P. sylvestris*, 1.vi.1964, 1 apt., 3 al. (*V.F.E.*). GERMANY: Berlin, Hohenstein, *P. sylvestris*, May 1939, 3 apt. ? fundatrices (*W. Storopys*), D.H.R.L. colln. ITALY: Moden, *P. sylvestris*, August 1923, 1 apt. (*C. Menozzi*). NETHERLANDS: Kootŵk, *P. sylvestris*, 16.v.1929, 3 apt., ? fundatrices (*D.H.R.L.* & colln.). Bennekom, *P. sylvestris*, 12.vi.1964, 2 apt., 2 al. (*J.P.D. & D.H.R.L.*). NORWAY: Lapland, Immerfoss, pine, 10.viii.1930, 2 apt. (*Oxford University Lapland Expedition*). POLAND: Gourein, Grodno (Bieloviesch), *P. sylvestris*, 11.vii.1908, 4 apt., 1 intermediate, 2 al. (*A. Mordwilko*). TURKEY: Istanbul, Baticeköy, *P. brutia*, 15.vii.1963, 1 al.; Istanbul, *P. sylvestris*, 6.v.1964, 1 apt., 1 al.; 5.vi.1964, 6 al.; Eskisehir-Fidanlik, *P. nigra*, 8.vi.1964, 2 apt.; Bolu-Aladag, 1360 m, *P. sylvestris*, 3.vii.1964, 5 apt., 2 al. (*H. Çanakçioğlu*). YUGOSLAVIA: Lesce pri Bledu, *P. sylvestris*, 1.viii.1967, 1 apt.; near *P. sylvestris*, 29.vii–1.viii.1967, 4 apt. (*V.F.E.*).

U.S.A.: Iowa, Ames, *Pinus sylvestris*, 11.vi.1924, 3 apt. (*F. C. Hottes*). Utah,

Logan, *P. sylvestris*, 30.ix.1939, 1 ovipara, 1 alate male (*W. P. Nye* coll., G. F. Knowlton leg.); pine, 5.vi.1942, 1 apt. (*E. Stoddard* coll., G.F.K. leg.); *Pinus nigra*, 5.x.1937, 1 apt. viviparae, 2 oviparae, 1 alate male, (*G.F.K. & F.C.H.*); 9.vii.1928, 2 apt. (*G.F.K.*); 5.x.1940, 2 apterae viviparae, 2 oviparae (*W. P. Nye* coll., G.F.K. leg.). Foot of Mount Logan, aspen, 1938, 7 apt. (*R. Nye* coll., G.F.K. leg.). CANADA: Manitoba, Winnepeg, *P. sylvestris*, 15.vi.1964, 2 apt., 2 al. (*A. G. Robinson*). New Brunswick, Frederickton, *P. sylvestris*, 12.vi.1960, 1 al. (*J. B. Adams* coll., M. E. MacGillivray leg.).

HOST-PLANTS. The usual host-plant is *Pinus sylvestris* and occasionally in dry areas, it occurs on *P. nigra*. *Cinara pinea* is also recorded from five other members of the *Lariciones* group, *P. densiflora*, *P. kesiya* (= *khasya*, *insularis*), *P. mugo*, *P. hamata* (= *sosnovskyi*) and *P. thunbergii*. *C. pinea* is also recorded from *Pinus banksiana* (= *divaricata*), *P. contorta* and *P. halepensis* of the *Insignis* group and from *Pinus scopulorum* of the *Australes* group.

DISTRIBUTION. Specimens of *Cinara pinea* have been seen from Czechoslovakia, England, Germany, Italy, Netherlands, Norway, Poland, Scotland, Turkey, Yugoslavia, U.S.A., Iowa, Utah; Canada, Manitoba, New Brunswick and Ontario. *C. pinea* is also recorded from Austria, Belgium, Bulgaria (Tashev, 1961 : 157), Hungary, Portugal (Ilharco, 1968*a* : 119), Roumania, Sweden, Switzerland, U.S.S.R., Estonia, Latvia, Lithuania, Ukraine, Georgia and Eastern Siberia, with queried identity (Grechkin, 1962 : 707), Wales (Thomas & Jacob, 1940 : 139, as *C. pini*) and Minnesota (Oestlund, 1922 : 118). Japanese records are now thought (Inouye, 1970 : 65) to apply to *Cinara piniformosana* (Takahashi).

BIOLOGY. Mr H. L. G. Stroyan has provided adult fundatrices collected between late March and late April in England. Apterae viviparae and a few alatae occur in May, both apterae and alatae viviparae are common in June and apterae viviparae are common but alatae are rarer in July. Apterae viviparae but no alatae have been collected in August. *C. pinea* has apparently not been collected in September in England. Oviparae and alate males occur in October, and one alata vivipara has been trapped in October. *C. pinea* lives on the young twigs and according to Withycombe (1923 : 532) is preyed upon by *Hemerobius nitidulus*.

NOTES. The alatae viviparae of *Cinara pinea* occur in three forms:

Length of first segment of hind tarsus	Total number of secondary rhinaria on both sides of body on antennal segments	
	III	IV + V
300–310μ	15–23	0–3
255–285μ	6–9	4–6
210–240μ	15–27	4–10

This pattern is typical of many aphids (e.g. *Rhopalosiphum maidis*) in which the apterae tend to be larger than the alatae and the alatae have more secondary rhinaria than the apterae. The number of secondary rhinaria on the third antennal segment is correlated both with size and with degree of alatiformity, while the number

of secondary rhinaria on the fourth and fifth antennal segments is correlated almost entirely with degree of alatiformity and is almost independent of size. The fourth and fifth antennal segments of aphids tend to be less affected by body size than is the length of the third antennal segment. The number of secondary rhinaria on the fourth and fifth antennal segments thus tend to be inversely correlated with body size. Similarly apterae with the first segment of the hind tarsi less than 240μ long are usually rather small, body length 3·1–4·5 mm but bear 1–3 secondary rhinaria in total on antennal segments IV + V. Apterae viviparae bearing secondary rhinaria on antennal segments IV or V rarely have the first tarsal segment of the hind leg exceeding 270μ long.

As the fundatrices are similar to the later generations of apterae viviparae the data are pooled in Table 1 (between pp. 172–173). The fundatrices have from 35–49 hairs on the fifth abdominal tergite between the siphunculi where the later generation bear 18–40 hairs.

Dale (1969 : 270) has illustrated the siphuncular aperture of *Cinara pinea*.

Dr D. Hille Ris Lambers informs me that his (1931 : 3) record of *pineti* from *Pinus austriaca* in Italy was based on a member of the *C. pini* group. Blanchard (1926 : 331–332, 1939 : 868–870) records *Cinara pineti* from Argentina but these records could apply to another species, possibly to *C. excelsae* H.R.L.

Cinara pini (L.)

Aphis pini L., 1758 : 453. [No types. SWEDEN: *Pinus sylvestris.*]

Aphis nuda pini DeGeer, 1773 : 27–39. [Types unknown. Locality not stated, presumably SWEDEN.]

Aphis pilosa Zetterstedt, 1840 : 311 partim. [Types. Entomologische Museum, Lund; LAPPLAND] (see Wahlgren, 1939 : 2).

Lachnus pini (L.) Kaltenbach, 1843 : 155–157; Koch, 1855 : 234–236.

Aphis pinicola (Kaltenbach) Walker, 1848 : 98; 1852 : 955–956 partim, nec Kaltenbach, 1843.

? *Lachnus pini* (Kaltenbach); Mordwilko, 1895*a* : 98; 1895*b* : 98–99.

[? *Lachnus taeniatus* (Koch) Mordwilko, 1895*b* : 100, 124–126, partim (see Szelegiewicz, 1962 : 2, footnote). Misidentification.]

? *Lachniella picta* Del Guercio, 1909 : 293–294. [Types unknown. ITALY: Monte Boni, *Pinus sylvestris*, 27.v.1905, aptera vivipara.]

? *Eulachnus abameleki* Del Guercio, 1909 : 316, 329–331. [Types unknown. Locality not stated, presumably ITALY, at the extremities of the branches of *Pinus sylvestris.*]

? *Eulachnus nudus* (De Geer) Del Guercio, 1909 : 339–341.

[*Panimerus pinihabitans* (Mordwilko) Theobald, 1929 : 132–135 partim. Misidentification.]

[*Cinara pineti* (Fabr.) Hille Ris Lambers, 1931 : 3. Misidentification.]

Cinara pini (L.) Börner, 1932 : 569; Braun, 1938 : 479–480; 491–492; Hille Ris Lambers, 1948 : 274–275; Szelegiewicz, 1962 : 86; Shaposhnikov, 1964 : 523; Pintera, 1966 : 296–299.

? *Cinara guadarramae* Mimeur, 1936 : 33–36. [Types, Institut Pasteur. SPAIN: Sierra de Guadarrama, 1,400 m, *Pinus sylvestris*, 10.ix.1935, apterae & alatae viviparae.]

? *Cinaria montanicola* Börner, 1939 : 76. [Types. Deutsches entomologisches Institut. Central & South GERMANY, *Pinus montana*]; 1952 : 43.

? *Cinaria setosa* Börner, 1950 : 2–3. [Types. Deutsches entomologisches Institut, AUSTRIA: *Pinus montana.*]

Cinaria longirostris Börner, 1950 : 3. [Types. Deutsches Entomologisches Institut, AUSTRIA: *Pinus sylvestris.*]

Cinaria polyseta Pašek, 1951 m.s. (see Pintera, 1966 : 296).
[*Cinaria nuda* (Mordwilko) Börner, 1952 : 42–43; Pašek, 1954 : 143–147, 149; Heinze, 1962 : 166. Misidentification.]
[? *Cinaropsis pilicornis* (Hartig); Gomez-Menor, 1962 : 382–386. Misidentification.]

MATERIAL STUDIED.

ENGLAND: Sussex, on *Pinus sylvestris*, Storrington, 17.v.1928, 1 aptera, 4 alatae & nymphs (*E. King*); Forest Row, on young growth, 22.vi.1964, 4 apt., (*E. J. Gatt*). London, Southgate, *P. sylvestris*, 26.vii.1848, 3 apt., 1 parasitized alata; 4.viii.1847, 7 apt., 2 al.; 19.x.1847, apterae viviparae & oviparae (*F. Walker*) 679–683. Surrey, Alice Holt, *P. sylvestris*, old wood, 4.vii.1961, 7 apt., 2 al. (*C. I. Carver & V.F.E.*). Hants, New Forest, near Lyndhurst, pine, August 1922, 2 al. (*F. Laing*). Cambridge, University botanic gdn, *P. sylvestris*, 14.xi.1950, 1 ovipara (*V.F.E.*).

CZECHOSLOVAKIA: Bianska Stiavnika, *P. sylvestris*, 10.v.1950, 1 fundatrix; 9.v.1949, 4 fundatrices; *Pinus montana*, 9.vi.1952, 1 apt.; *P. montana* var. *pumilio*, 17.vi.1952, 2 apt.; Gelnica, *P. sylvestris*, 7.vi.1952, 8 fundatrices, 5 in D.H.R.L. colln. Malacky, *P. sylvestris*, 18.v.1950, 2 al. & nymphs. Zarnovica, *P. sylvestris*, 15.ix.1952, 2 apt. (*V. Pašek*). Bzendec, 29.v.1964, 1 al. (*V.F.E.*). FRANCE: Colbach, *P. sylvestris*, 5.v.1965, 1 fundatrix, Laurent (*D. Hille Ris Lambers* colln.). NETHERLANDS: Bennekom, *P. sylvestris*, 14.v.1947, 4 fundatrices; 30.ix.1946, 2 oviparae, 3 apterous males (*D. Hille Ris Lambers*); 12.vi.1954, 5 apt., 4 al. (*D.H.R.L. & J. P. Doncaster*). NORWAY: Espeland, Fana, trapped, 28.vi.1954, 2 al. (*H. Tambs-Lyche*). RUSSIA: Petrograd, *P. sylvestris*, 2 apt. & nymph (*A. Mordwilko*). TURKEY: Bolu Aladag, 1360 m, *P. Sylvestris*, 3.vii.1964, 13 apt., 1 al. (*H. Çanakçioğlu*).

HOST-PLANTS. The usual host-plant is *Pinus sylvestris* and there are also records from *P. mugo* including its subspecies *P. m. mughus* and *P. m. pumilio* and from *P. nigra* (= *austriaca*) including *P. n. maritima* (= *calabrica, laricio*) of the *Lariciones* group. There are also records from *P. banksiana* (= *divaricata*), *P. halepensis* and *P. montana* of the *Insignes* group, from *Pinus ponderosa* and the subspecies *P. p. scopulorum* of the *Australes* group and from *P. cembra*.

DISTRIBUTION. *Cinara pini* has been seen from Czechoslovakia, England, France, Netherlands, Norway, Russia (Leningrad) and Turkey and has also been recorded from Austria, Germany, Italy, Poland, Scotland, Sweden, Ukraine, Latvia and Yugoslavia. There are also a number of records from North America but as far as known these apply to *Cinara pinea*. No authentic Scottish specimens have been seen although *C. pini* may well occur in Scotland.

BIOLOGY. English apterae and alatae viviparae have been collected in May, July and August and oviparae in November. Dr D. Hille Ris Lambers has provided Dutch and French fundatrices collected in May and Dutch oviparae and apterous males collected in late September. Pintera (1966 : 298) comments that 'alatae viviparous females may occur in the course of the whole vegetative period'. In July *Cinara pini* lives on the underside of the old branches and according to Pintera (1966 : 297–298) it lives on the young shoots in the spring. Wood-Baker (1951 :

271) records *C. pini* feeding around the edge of a resinous scar in Northern Italy, behaviour reminiscent of Tissot & Pepper's (1967 : 1–10) records of associations of some North American *Cinara* species with Pine Rust lesions. The relationship with ants has been discussed by Kloft (1960 : 48–49) and Börner & Franz (1956 : 306) and the honeydew has been studied by Zoebelein (1956 : 374).

NOTES. The name *Aphis pini* has been applied to two different species of *Cinara*: to that here called *Cinara pini* (L.) and to *C. pinea* (Mdw.). Hottes (1930 : 186–187), Hille Ris Lambers (1948 : 274–275) and Stroyan (1955 : 332–333) have summarized the arguments. The name *C. pini* is used here in the sense of *Aphis nuda pini* De Geer but Mordwilko's *Cinara nuda* is *C. escherichi* Börner, which Shaposhnikov (1964 : 523) calls *C. nuda* (Mordwilko). According to specimens from Leningrad in the BMNH collection, Mordwilko also determined specimens of *C. pini* as *nuda*.

Cinara pini is a member of a taxonomically difficult group of species. Summer apterae of *C. pini* have 3–8 hairs on the fifth abdominal tergite but fundatrices have 22–36 hairs on the fifth tergite between the siphunculi. Large specimens in the spring have 6–8 accessory hairs on the fourth rostral segment while the usually smaller summer apterae viviparae bear 8–10 accessory hairs on the fourth rostral segments. Specimens from *Pinus sylvestris* have the fourth rostral segment 140–180μ long but specimens from *P. montana* have the fourth rostral segment 175–210μ long and probably belong to a distinct (sub-) species, *C. montanicola* Börner, which may be a synonym of *C. guadarramae* Mimeur. *Cinara setosa* Börner may be based on fundatrices of this subspecies.

The summer dwarfs of *Cinara pini* are similar to *C. palaestinensis* Hille Ris Lambers, which has even smaller siphuncular cones and usually bears relatively longer hairs on the third abdominal tergite and hind tibiae, and lives on *Pinus brutia* in the Mediterranean region.

Cinara canatra Hottes & Bradley from *Pinus banksiana* in North America is similar to *C. pini* except that the dorsum of *C. canatra* is pigmented and the processus terminalis often bears 5 or 6 sub-apical setae as in *C. escherichi*. *Cinara brevispinosa* Gillette & Palmer from *Pinus contorta* in North America resembles *C. pini* but the longest hairs on the eighth abdominal tergite of *C. brevispinosa* are only 35–50μ long (55–160μ in *C. pini*) and the ultimate rostral segment bears only 4 or 5 accessory hairs. *Cinara taedae* Tissot from *Pinus rigida* in North America is similar to *C. pini* but apterae of *C. taedae* of body length 2·1–2·7 mm have the fourth rostral segment 200–220μ long (150–180μ in *pini*) and the longest hairs on the eighth abdominal tergite are 50–65μ long and only about twice as long as the 25–35μ long hairs on the third abdominal tergite (in *C. pini*, 55–160μ on the eighth abdominal tergite and 15–33μ on the third abdominal tergite). *Cinara pinata* Hottes from *Pinus edulis* and *C. thatcheri* Knowlton & Smith from *P. ponderosa* in North America also resemble *C. pini* but their fourth rostral segments bear about 22–24 accessory hairs (6–10 in *pini*).

Cinara pinihabitans (Mordwilko)

? *Aphis pilosa* Zetterstedt, 1840 : 311 partim. [Types, Entomologische Museum, Lund. LAPPLAND, see Wahlgren, 1939 : 2–3.]

[*Aphis pinicola* (Kaltenbach) Walker, 1852 : 955–956 partim. Misidentification.]
Lachnus pinihabitans Mordwilko, 1895*a* : 75, 79, 94, 98. [Types, Polish Academy of Sciences. POLAND: Otwock near Warsaw]; 1895*b* : 97–98, 118–119; Cholodkovsky, 1898 : 638–640; 1902 : 7.
[? *Lachnus taeniatus* Koch; Schouteden, 1906 : 207. Misidentification.]
Lachniella pinihabitans (Mordwilko) Jackson, 1919 : 165.
Dilachnus pinihabitans (Mordwilko) Swain, 1921 : 227–228.
Panimerus pinihabitans (Mordwilko) Theobald, 1929 : 132–135 partim, only the Southgate, 1847 and Scottish, 1917, records; the others are based on specimens of *Cinara pilicornis* and *C. costata*.
Cinara pinihabitans (Mordwilko) Börner, 1932 : 569 partim; Braun, 1938 : 479; Szelegiewicz, 1962*a* : 87; 1962*c* : 245–249; Pintera, 1966 : 301–302; Ilharco, 1968*a* : 119.
Cinaria pinihabitans (Mordwilko) Börner, 1950 : 2.
[*Cinaria taeniata* (Koch) Börner, 1952 : 42; Pašek, 1954 : 151–153; Heinze, 1962 : 166; Gomez-Menor, 1962 : 373–376. Misidentification.]

MATERIAL STUDIED.

ENGLAND: London, Southgate, *Pinus sylvestris*, 4.vi.1847, 2 alatae and nymphs, *F. Walker*, 678. Kent, Wye, 15.vii.1969, 1 al. (*N. R. Maslen*) Forestry Commission colln. Herts, Harpenden, trap F2, 17.vi.1944, 1 al. (*J. P. Doncaster*). Whetstone, light trap, 12.v.1959, 1 al. (*P. H. Ward*). Gloucs., Sodley Ponds, *Castanea sativa*, 2 al., 13.vi.1959 (*R. S. George*). Hants, Liphook, *P. sylvestris*, 26.v.1918, 1 al. (*W. C. Crawley*). Alice Holt, suction trap, 6.vi.1969, 4 al.; 29.vi.1969, 1 al. (*N. R. Maslen*), Forestry Commission colln. SCOTLAND: Morayshire, Rothes, *Pinus sylvestris*, 28.ix.1917, 2 larvae (*D. J. Jackson*). Fife, Dundee, 40′ trap, 27.vi.1968, 1 al., Forestry Commission colln.

FINLAND: Aland, Lemland, *Pinus sylvestris*, 17.vi.1966, 2 apterae (*F. Ossiannilsson*). GERMANY: Serbst, *P. sylvestris*, 26.x.1942, 1 ovipara, 1 alate male (*K. Heinze*). SWEDEN: Uppsala, Björklinge, *P. sylvestris*, 31.vii.1963, 1 apt., 1 al. (*F. Ossiannilsson*).

HOST-PLANTS. *Cinara pinihabitans* has only been seen from *Pinus sylvestris* but there are also records from *Pinus mugo* subsp. *mughus*.

DISTRIBUTION. Specimens have been seen from England, Finland, Germany, Scotland and Sweden and are also recorded from Austria, Czechoslovakia, Ireland, Poland, Portugal, U.S.S.R., Ukraine (Mamontova, 1964 : 54) and Latvia.

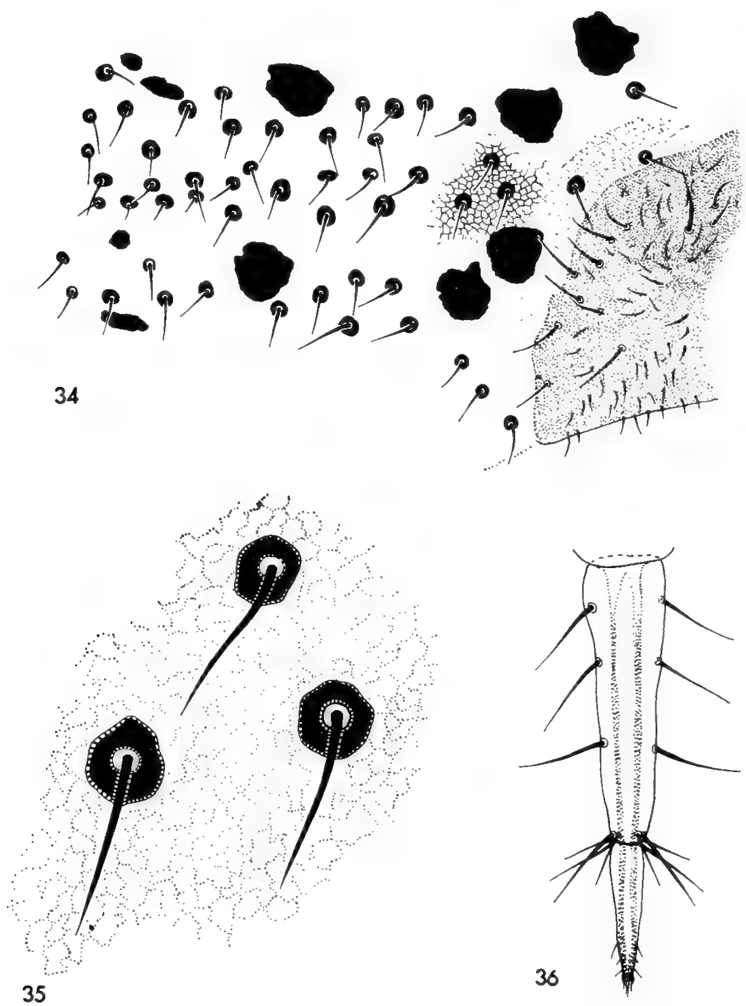
BIOLOGY. Alatae occur in traps in May and the first half of June in England but English apterae have not been seen, perhaps they occur high up the tree. The males are described as alate but little else is known about the biology.

NOTES. *Cinara pinihabitans* has been cited as the type-species of *Neodimosis* Toth, 1935, since it was the only species included. *Neodimosis* is probably a *lapsus* for *Neochmosis* and it is not certain which species Toth studied. The name *Cinara taeniata* (Koch) has been used for several different species including *C. pinihabitans*. Braun (1938 : 479) probably had a mixture of species under both *C. pinihabitans* and *C. taeniata*. Theobald's (1929 : 133–135) *pinihabitans* consisted mostly of *C. pilicornis* and *C. costata*. According to Heinze (1962 : 166) *C. longirostris* Börner is similar to, if not identical with, *C. pinihabitans*. *Cinara abamaleki* (Del Guercio) appears to be an Italian member of this group and could be an older name for *C. maghrebica* Mimeur.

Cinara schimitscheki Börner

(Text-figs 34–36)

Cinara schimitscheki Börner, 1940 : 1. [Types, Deutsches Entomologisches Institut. CENTRAL EUROPE, ends of twigs of *Pinus austriaca*]; 1952 : 41; Pašek, 1954 : 173–175; Stroyan, 1957 : 348; Heinze, 1962 : 158; Shaposhnikov, 1964 : 523; Pintera, 1966 : 287–288.
Cinara kosarowi Tashev, 1962 : 207–210. [Types, University of Sofia. BULGARIA: *Pinus leucodermis*, 9.viii.1960.]
Cinara (*Cinarella*) *schimitscheki* Börner; Çanakçioğlu, 1966 : 139.



FIGS 34–36. *Cinara schimitscheki*, aptera vivipara. 34, part of right side of fifth abdominal tergite, × 87. 35, enlargement of part of 34, × 450. 36, fourth and fifth rostral segments.

MATERIAL STUDIED.

ENGLAND: Surrey, Kew Gardens, *Pinus nigra*, 31.v.1968, 2 apterae; 30.vi.1969, 2 apt. (*V.F.E.*). Cambridge, University botanic gdn, *Pinus nigra* var. *calabrica*, 9.x.1950, 1 apt. (*H. L. G. Stroyan* & colln.).

BULGARIA: Rodopy, *Pinus* sp. (*nigra*), 31.v.1959, 2 alatae (*R. Bielawski*, H. Szelegiewicz colln. 1176). CZECHOSLOVAKIA: Bianska Stiavnika, *Pinus nigra*, 7.vii.1952, 1 apt. (*V. Pašek*). TURKEY: Eskisehir, Fdanlik, *Pinus nigra*, 8.vi.1964, 2 apt., 1 al. (*H. Çanakçioğlu*).

HOST-PLANTS. *Cinara schimitscheki* has been seen from *Pinus nigra* (= *austriaca*), from its variety *P. n. maritima* (= *calabrica*, *laricio*), is also recorded from the varieties *P. n. caramatica* (= *pallasiana*), *P. n. leucodermis* (as *Cinara kosarowi*) and from *Pinus mugo* subsp. *mughus*.

DISTRIBUTION. *Cinara schimitscheki* has been seen from Bulgaria, Czechoslovakia, England, Turkey and is also recorded from Austria, Germany, Hungary and the U.S.S.R., Crimea.

BIOLOGY. In May and June *Cinara schimitscheki* lives on the young shoots of *Pinus nigra* but according to Pašek (1954) teste Pintera (1966 : 288) it lives under the bark of the older branches later in the year.

NOTES. So few samples are known that it is difficult to evaluate the thickened hairs by which *Cinara kosarowi* was differentiated from *schimitscheki*.

Cinara stroyani (Pašek) **stat. n.**

[*Lachnus piceicolus* Cholodkovsky; Schouteden, 1906 : 207; van der Goot, 1915 : 402–403. Misidentification.]
[*Dilachnus piceicolus* (Cholodkovsky) Wellenstein, 1930 : 748, 751. Misidentification.]
[*Cinara piceicola* (Cholodkovsky) Börner, 1932 : 480, 491; Braun, 1938 : 480, 491; Hottes, 1955 : 76–77; Stroyan, 1964 : 30–31; Pintera, 1966 : 302–304. Misidentification.]
Cinaropsis drastichi Pašek, 1951 m.s. [see Pintera, 1966 : 3026].
Cinaropsis taxicola Pašek, 1951 m.s. [see Pintera, 1966 : 302].
Cinaropsis minor Pašek, 1951 m.s. [see Pintera, 1966 : 302].
[*Cinaropsis cistata* (Buckton) Börner, 1952 : 43; Heinze, 1964 : 171. Misidentification.]
[*Cinaria* (*Cinaropsis*) *cistata* (Buckton) Pašek, 1954 : 202–207. Misidentification.]
Cinaropsis cistata var. *stroyani* Pašek, 1954 : 207. [Types, Slovak Academy of Science, Bratislava. NETHERLANDS, leg. H. L. G. Stroyan.]
[*Cinara cistata* (Buckton) Ossiannilsson, 1955 : 378; Szelegiewicz, 1962 : 81; Shaposhnikov, 1964 : 522. Misidentification.]

MATERIAL STUDIED.

ENGLAND: Kent, Bromley, *Picea abies*, 5.vii.1965, 1 alata (*H. C. Dale*). Surrey, Kew Gardens, *Picea obovata*, 16.vi.1961, 1 al. (*V.F.E.*).

CZECHOSLOVAKIA: Westerheim, *Picea*, 14.vi.1932, 1 aptera, 1 alata (*D. Aubertin*). Banska Stiatnika, *P. excelsa*, 7.v.1949, 2 fundatrices; 17–23.vi.1952, 5 apt.; Gelnica, *P. excelsa*, 6.v.1952, 5 fundatrices, 2 in D. Hille Ris Lambers colln.; 26.vi.1952, 1 apt., 1 al.; Polana Mount., *P. excelsa*, 9.vii.1951, 2 apt.; Zarnovica, *P. excelsa*, 15.ix.1952, 1 ovipara (*V. Pašek*). Praha—kosire, *P. abies*, 4.vi.1952, 2 apt. (*A.*

Pintera). GERMANY: Tschdf, *P. excelsa*, 29.vii.1944, 1 apt. (*K. Heinze*). Unteres Weldental-schwaiswalt, *P. excelsa*, 15.vi.1944, 1 apt., 1 al. (*K. Heinze*). NETHERLANDS: Bennekom, *Picea*, 21.vi.1949, 4 al. (*D. Hille Ris Lambers & H. L. G. Stroyan* & colln.). POLAND: Bydgoszcz-Jacheice, *P. excelsa*, 4.viii.1956, 1 imm. apt., 1 alatoid nymph (*H. Szelegiewicz*). SWEDEN: Brunnby, Küllen, *P. abies*, 25.viii.1964, 3 apt. (*F. Ossiannilsson* & colln.).

HOST-PLANTS. *Cinara stroyani* has been seen from *Picea abies* (= *excelsa, rubra* A. Dietr. nec Du Roi) and is recorded from *P. pungens*, which also belongs to the *Eupicea* group.

DISTRIBUTION. *Cinara stroyani* has been seen from Czechoslovakia, England, Germany, Netherlands, Poland and is also recorded from Austria, Bulgaria, Norway (Stenseth & Bakke, 1968 : 238), Sweden, U.S.S.R., Estonia, Latvia (Zirnits, 1927 : 251), Ukraine.

BIOLOGY. In Czechoslovakia, according to Pintera (1966 : 302–304) the fundatrices of *C. stroyani* occur on the two year old shoots on the shady side of spruce trees and are attended by ants. Alatae occur in large numbers in May in the second and third generations and fly to the current years' shoots to deposit their young. As the summer progresses the colonies move to the older branches near the trunk but have not yet been discovered on the roots. According to Börner & Franz (1956 : 307) *C. stroyani* is mostly on the roots in summer. Oviparae are recorded from July onwards. Saemann (1966 : 380) and Kloft (1960 : 49) have also written on the biology and Zoebelein (1956 : 380) has studied the honeydew.

NOTES. Records of *Cinara piceicola* between 1915 and 1966 mostly apply to *C. stroyani* but Inouye (1938 : 80) had *C. horii* Inouye, 1956. Palmer's (1952 : 39–40) description of metatypes of *C. piceicola* suggest that it is a synonym of *C. pilicornis*. Continental authors suspecting this synonymy used the name *cistata* Buckton for the species. Buckton's specimen is *Cinara costata* from Walker's collection and had been correctly determined by Walker, but the '*o*' in *costata* was not closed and Buckton misread the name as *cistata*.

According to Pintera (1964 : 304, 306) *C. stroyani* is very common in Central and Northern Europe. It is not common in England and this, together with the difficulty in separating *stroyani* from *pilicornis*, may indicate either an ecological difference between the two species or possibly that they are only forms of the same species.

Cinara tujafilina (Del Guercio)

(Text-figs 39–41)

Lachniella tujafilina Del Guercio, 1909 : 288, 311–312. [Types unknown. ITALY: nr Firenze, *Thuja*, 15.vi.1905, aptera.]

Lachnus thujafilinus (Del Guercio) Davidson, 1914 : 127.

Lachniella thujafolia Theobald, 1914 : 335–336. ['Paratypes' in BMNH with data as given in the original description, SOUTH AFRICA: Transvaal, Ondersteport & Pretoria, *Thuja orientalis*, April & August, 1913, apterae viviparae. The specimen labelled 'type' in

Theobald's collection is an alata vivipara, a form not mentioned in the original description, collected from the Orange Free State, 27.viii.1914, a locality not mentioned in the original description.]

Lachnus thujafolia (Theobald) Takahashi, 1921 : 81.

Lachnus biotae van der Goot, 1917 : 161–163. [Types unknown. JAVA: Buitenzorg, 250 m, *Biota orientalis*, December, 1914, apterae & alatae viviparae.]

Lachnus tujafilinus (Del Guercio) Swain, 1919 : 50; Zimmerman, 1948 : 63–64.

Dilachnus thujafolia (Theobald) Hall, 1926 : 3; Okamoto & Takahashi, 1927 : 144.

Dilachnus callitris Froggatt, 1927 : 56–58. [Types unknown. AUSTRALIA: New South Wales, *Callitris*, 1921 & 1925.]

[? *Dilachnus juniperi* (F.); Nevsky, 1929 : 350–351. Misidentification.]

Cinara thujafoliae (Theobald) Takahashi, 1931 : 24; Mimeur, 1934 : 1.

Dilachnus tujafilinus (Del Guercio) Smith, 1932 : 86.

Panimerus thujafoliae (Theobald) Lepiney & Mimeur, 1932 : 128.

Cinara tujafilina (Del Guercio) Börner, 1932 : 570; Boudreaux, 1948 : 98; Smith, Martorell & Escolar, 1963 : 52–53.

Cinara winokae Hottes, 1934 : 1–2. [Type, USNM; U.S.A., Louisiana, Arbor Vitae, 31.xii.1931, alata vivipara.]

Neochmosis tujafilina (Del Guercio) Hille Ris Lambers, 1935 : 63.

[*Cinara juniperi* (De Geer); Blanchard, 1939 : 866–868; Waterston, 1949 : 7; ? Dzhibladze, 1958 : 293 partim. Misidentification.]

Cupressobium tujafilinum (Del Guercio) Börner, 1952 : 44–45; Heinze, 1962 : 176.

Cupressobium thujaphilinum (Del Guercio) Börner & Heinze, 1957 : 57.

Cinara (*Cupressobium*) *tujafilina* (Del Guercio) Eastop, 1958 : 92.

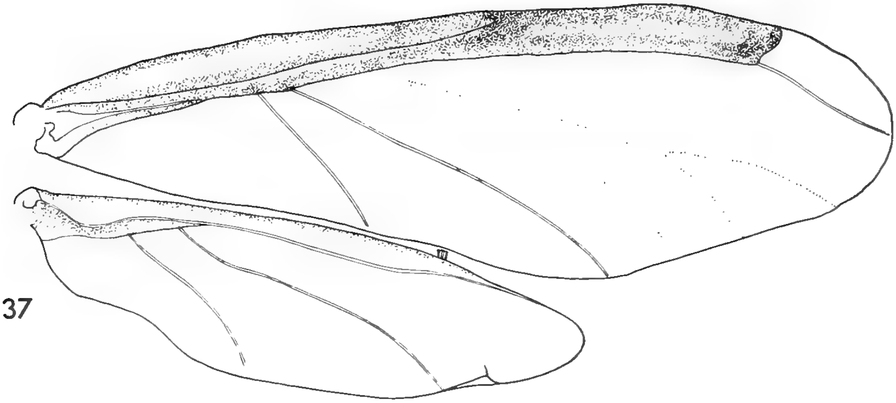
Cupressobium tujafilina (Del Guercio) Gomez-Menor, 1962 : 393–397.

? *Cupressobium mediterraneum* Narzikulov, 1963 : 113–117. [Type, Pavlovsky Institute of Zoology & Parasitology. U.S.S.R., Tadzhikistan, Dushanbe, 29.v.1958, M.N.N.]

MATERIAL STUDIED.

ENGLAND: Surrey, Wimbledon, Thuja, 5.vi.1935, 2 apterae (*C. T. Gimmingham*); Wallington, cypress, June 1965, 28 apt. (*Public Health Dept.*). Essex, Woodford, fir, 5.vi.1944, 4 apt. Berks, Reading, *Chamaecyparis lawsoniana*, 9.v.1948, 5 apt.; *Cupressus* sp., 3.vi.1950, 11 apt. (*V.F.E.*). Hants, Alice Holt, suction trap, 1.vii.1969, 1 alata (*N. R. Maslen*), Forestry Commission colln. Cambridge University Botanic gdn, *Thuja orientalis* var. *elegantissima*, 9.v.1952, 2 apt.; *Thuja* sp., 15.vii.1951, 8 apt. (*V.F.E.*).

EGYPT: Cairo, *Thuja orientalis*, February 1918, 3 apt. (*A. Alfieri*). Giza, *Thuja*, 12.iii.1924, 2 apt., 1 al., 2 alatoid nymphs; Gezireh, *Thuja*, 6.iv.1924, 6 apt., 3 al. (*W. J. Hall*). GERMANY: Elsheim, Friedhof, *Biota orientalis*, 5.ix.1930, 2 apt. (*C. Börner*), K. Heinze leg. IRAQ: Kirur, *Thuja*, 16.iii.1968, 12 apt., 2 al. (*H. E. Knopf*). ITALY: Rome, *Juniperus communis*, 25.iii.1960, 7 apt. (*F. Silvestri*), E. Tremblay leg. (2 in Inst. Ent. Agr., Portici colln.) JAPAN: *Thuja orientalis*, 3 apt. (*R. Takahashi*), ex Theobald colln. MOROCCO: Casablanca, *Thuja occidentalis*, May 1929, 16 apt.; Rabat, *Biota occidentalis*, July 1929, 1 apt., 1 al. [Bouhelier, see Mimeur, 1933 : 1], F. V. Theobald colln. NETHERLANDS: Wageningen arboretum, *Thuja occidentalis ohlendorffi*, 19.vi.1954, 1 apt. (*D. Hille Ris Lambers & J. P. Doncaster*). PALESTINE: Jerusalem, *Thuja orientalis*, 26.v.1946, 3 apt. (*E. Swirski*). Without locality, *Thuja*, 20.ii.1938, 2 apt. (*S. Dauderari*). TURKEY: Istanbul, Bahceköy, 110 m, *T. orientalis*, 5.vi.1964, 21 apt., 1 al. (*H. Çanakçioğlu*).



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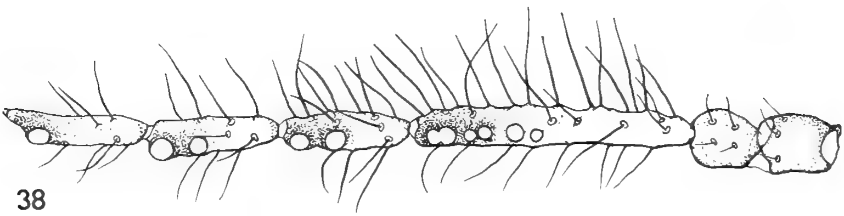

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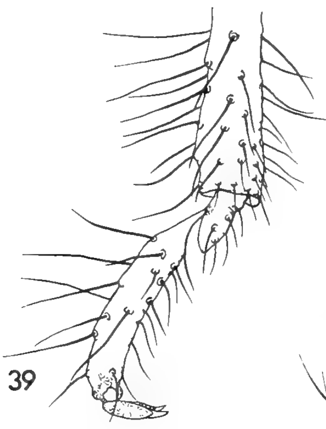

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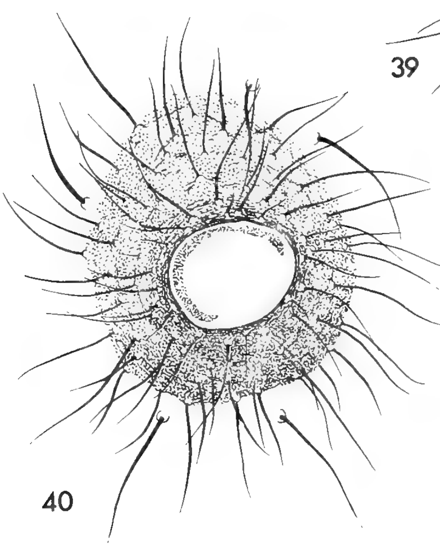

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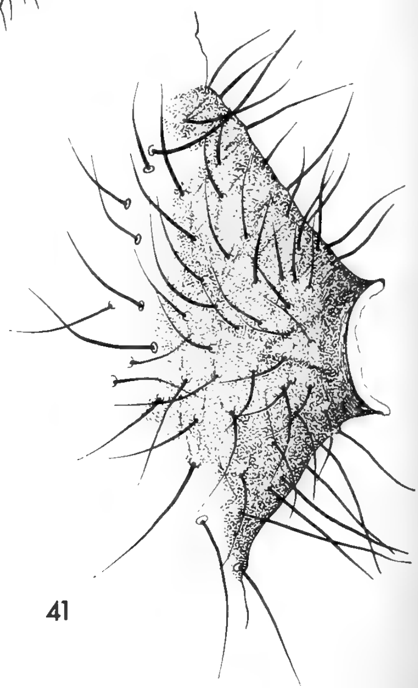

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FIGS 37–41. *Cinara tujafilina*, alata vivipara. 37, wings, × 27. 38, antenna, × 100. 39, hind tarsus, × 100. 40 & 41, siphuncular cone, dorsal and lateral views, × 240.

ERITREA: Asmara, *Thuja orientalis*, 15.viii.1948, 3 apt., 2 al. (*G. de Lotto*). MALAWI: Mt Mlanje, 6000′, *Widdringtonia whytei*, 28.vii.1956, 6 apt., 2 al. (*A. McCrae*); June 1958, 2 apt. (*G. W. Hearn*). RHODESIA: Salisbury, *Callitris robusta*, 19.vi.1915, 1 al., 28.ii.1957, 2 immature (*Dept. Agric.*); *Thuja* sp., 11.v.1928, 4 immature; 21.vi.1928, 3 apt. (*W. J. Hall*). *Thuja orientalis*, June 1930, 1 apt.; *T. orientalis*, on roots with ants, 22.v.1965, 1 apt., 8 immature (*Dept. Agric.*). SOUTH AFRICA: Transvaal, Onderstepoort, *T. orientalis*, 6.iv.1913, 1 apt., many immature including 1 alatoid nymph, on 4 slides, paratypes of *thujafolia* Theobald. Pretoria, *T. orientalis*, 1.viii.1913, 4 apt., many immature (*J. Bedford*), paratypes of *thujafolia*, mounted on 7 slides. Orange Free State, Petrusburg, *Thuja*, 27.viii.1914, 1 al., labelled 'type' of *thujafolia* but the alata was not described in the original description, nor is Orange Free State given as a locality. Ladybrand, *Thuja*, 12.viii.1914, 3 apt.; Blomfontain, *Cupressus*, 30.viii.1917, 2 alatoid nymphs, F. V. Theobald colln. Harrismith, 1–20.iii.1927, 2 al. (*R. E. Turner*).

NEPAL: Kathmandu, conifer, 14.xii.1960, 2 apt. (*K. C. Sharma*).

AUSTRALIA: New South Wales, Dubbo, *Callitris endlichi*, 12.x.1959, 3 apt. (*K. M. Moore*). Desert cypress, 24.ix.1921, 2 apt., 2 al. (*W. W. Froggatt*), presumably part of the series from which *callitris* Froggatt was described. Matong State Forest, *Callitris glauca*, 17.xii.1956, 11 apt., 2 in N.S.W. Forest Dept. colln. Buckinbong S.F., *C. glauca*, 20.xii.1956, 4 apt., 3 in N.S.W. Forest Dept. colln. Pennant Hills, *C. rhomboidea*, 31.vii.1958, 10 apt., 1 al.; Stahom S.F., 30.vii.1959, 2 apt., 6 al. (*K. M. Moore*). A.C.T., Canberra, *Chamaecyparis lawsoniana*, 6.ix.1959, 1 apt.; *Libocedrus decurrens*, 3.ix.1959, 2 apt. (*V.F.E.*). Tasmania, Coles Bay, *Callitris tasmanica*, 26.v.1952, 2 apt. (*K. A. Pickett*). Victoria, Colstream, 9.ix.1949, 6 apt. (*Mrs Lithgow*). Melbourne, *Thuja orientalis*, 29.v.1959, 7 apt., 1 alatoid nymph; 23.vi.1959, 8 apt., 2 alatoid nymphs; 3–10.vii.1959, 20 apt., 27 al.; *Thuja occidentalis*, 30.vi.1959, 1 apt.; *T. occidentalis* cultivar 'Rheingold', 30.vi.1959, 21 apt. (*V.F.E.*).

BERMUDA: Paget E., *Juniperus bermudiana*, 15.v.1943, 17 apt. (*J. M. Waterston*). U.S.A.: California, Riverside, *Thuja occidentalis*, 8.ix.1916, 1 apt., 1 al. (*A. F. Swain*). Texas, Crystal Springs, *Thuja*, 22.ii.1936, 4 apt., 1 alatoid nymph (*M. J. James* coll.), G. F. Knowlton leg. Utah, St George, *Thuja*, 22.iii.1946, 14 apt., 3 al.; evergreen tree, 24.iii.1951 (*M. S. Burmingham* coll.); Green River, arbor vitae, 16.v.1958, 24 apt.; Murra, *Juniperus* sp., 27.x.1964, 1 apt., 4 larvae (*G. F. Knowlton*).

HOST-PLANTS. The usual host-plant is *Thuja* (*Biota*) *orientalis* but specimens have also been seen from the following Cupressaceae, *Thuja occidentalis*, *Callitris columellaris* (= *glauca*), *C. endlichi*, *C. priessii* (= *robusta*), *C. rhomboidea*, *C. tasmanica*, *Chamaecyparis lawsoniana*, *Juniperus virginiana*, *Libocedrus decurrens* and *Widdringtonia whytei*.

DISTRIBUTION. *Cinara tujafilina* has been seen from Egypt, England, Germany, Iraq, Japan, Morocco, Netherlands, Palestine, Turkey, Eritrea, Malawi, Rhodesia, South Africa, Nepal, Australia, Bermuda, U.S.A., California, Texas and Utah. *C. tujafilina* was originally described from Italy and is also recorded from Bulgaria

(Tashev, 1964 : 173), Portugal (Ilharco, 1968*a* : 64), Spain, Mozambique (Ilharco, 1970 : 2–3), Puerto Rico, Florida (Tissot, 1939 : 42), Louisiana and Missouri (Kring, 1955 : 64).

BIOLOGY. The distribution of *Cinara tujafilina* is much wider in the warmer and drier parts of the world than most other species of *Cinara*. Large numbers of apterae occur on the undersides of the branches near the trunk in June and smaller numbers of apterae in May and July. Alatae have not been collected in Britain. According to Bray (1953 : 103–107) *C. tujafilina* occurs on the roots in the summer. According to Waterston (1949) it is attended by the ant *Pheidole megacephala*. Tissot (1939 : 42), Waterston (1949 : 7) and Weigel & Baumhofer (1948 : 19–20) record the damage caused by this aphid and Gomez-Menor (1963 : 397) says that *C. tujafilina* is primarily controlled by *Chilocorus bipustulus* in Spain. Lepiney & Mimeur (1932 : 28) record *Scymnus subvillosus* as a predator in Morocco. Froggatt (1923 : 163) gives an account of an outbreak of the 'Cypress Pine Aphis' in New South Wales in 1921 but did not formally describe the aphid and apply a latin binomen until 1927.

NOTES. *Cinara tujafilina* is more common on *Thuja orientalis* and *Cinara cupressi* is more common on *Thuja occidentalis* but Blanchard's description of *Cinara juniperi* from *Thuja occidentalis* in Argentina seems to apply neither to *juniperi* nor to *cupressi* but to *C. tujafilina*. Tashev (1944 : 173) on the other hand may have had *Cinara cupressi*.

A single aptera (body length 2·5 mm) and 4 larvae collected on *Juniperus excelsa*, Turkey, Bardur Sarnic, 1300 m, 3.vii.1970 by Dr H. Çanakçioğlu are similar to *C. tujafilina* except that the longest hairs on the hind tibiae are only 128µ long. The longest hairs on the hind tibiae of *C. tujafilina* are 140–240µ long and are only less than 155µ in specimens less than 1·8 mm long. The Turkish specimens probably represent a hot weather form of *C. tujafilina* but may be a distinct (sub-) species, possibly *C. mediterraneum* (Narzikulov).

HOST PLANTS OF THE BRITISH SPECIES OF *CINARA*

PINACEAE

Abies spp.
Cinara abieticola, C. pectinatae

Cedrus spp.
Cinara abieticola

Larix and Pseudolarix spp.
Cinara boerneri, C. kochiana, C. laricis

Picea (Eupicea) abies (= excelsa) glauca (= alba, canadensis), orientalis, pungens
Cinara bogdanowi, C. costata, C. piceae, C. pilicornis, C. stroyani

Picea (Cascita) engelmanii, jezoensis, likiangensis, sitchensis
Cinara costata, C. piceae, C. pilicornis

Picea (Omorika) breweriana, omorika, spinulosa
Cinara costata, C. piceae

Pinus (Insignes) banksiana (= divaricata), contorta, halepensis, montana

Cinara pinea, C. pini

Pinus (Lariciones) mugo including mughus

Cinara pinea, C. pini, C. pinihabitans

Pinus (Lariciones) nigra (= austriaca) including caramatica (= pallasiana), leucodermis, maritima (= calabrica, laricio)

Cinara acutirostris, C. brauni, C. schimitscheki and occasionally *C. pinea*

Pinus (Lariciones) sylvestris including hamata (= sosnovskyi)

Cinara escherichi, C. pinea, C. pini, C. pinihabitans

Pinus (Australes) ponderosa including scopulorum

Cinara pinea, C. pini

CUPRESSACEAE

Callitris, Chamaecyparis, Libocedrus spp.

Cinara tujafilina

Cupressus arizonica, torulosa

Cinara fresai

Cupressus goveniana

Cinara cupressi

Cupressus macrocarpus

Cinara cupressi, C. fresai

Juniperus bermudiana

Cinara tujafilina

Juniperus chinensis, communis, oxycanus, oxycedrus

Cinara juniperi

Juniperus horizontalis, sabina

Cinara fresai

Juniperus virginiana

Cinara cupressi

Thuja occidentalis

Cinara cupressi and rarely *C. tujafilina*

Thuja (Biota) orientalis

Cinara tujafilina

ACKNOWLEDGEMENTS

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Table 1

Biometric data for the apterae viviparae of the British species of *Cinara*

	Host plant	Number of specimens	Body length mm	Diameter of siphuncular cone	Mesosternal tubercle	Chitinized rim of primary rhinaria	Scleroites on abdominal tergites 2–5	Length in μ of antennal segments III	IV	V	VI	Length of rostral segments in μ IV	V	First segment of hind tarsus in μ basal diameter	dorsal length
piceae	*Picea*	19	3·2–6·7	170–630	absent	present	absent	530–1110	180–370	300–550	120–200 + 40–81	300–370	120–145	45–80	51–92
fundatrix	,,	10	5·4–6·7	340–510	,,	,,	,,	820–920	230–310	360–420	170–210 + 22–51	300–350	120–150	70–80	62–77
kochiana	*Larix*	12	5·7–6·1	410–530	,,	,,	very small	720–980	290–460	390–530	130–200 + 56–88	320–420	120–150	53–66	62–94
boerneri	,,	54	2·4–4·1	170–300	,,	absent	very small	500–720	230–320	280–390	130–190 + 26–52	150–210	85–105	42–53	79–112
laricis	,,	29	2·5–5·1	230–630	low	present	large	410–670	140–300	190–370	100–140 + 22–35	160–210	80–100	34–60	57–96
acutirostris	*Pinus nigra*	17	2·8–4·1	390–710	present	present	very small	530–650	180–300	230–330	130–170 + 34–49	210–250	110–130	40–46	44–53
fundatrix	,, ,,	2	3·3–3·5	290–370		,,	,, ,,	440–470	150–200	190–230	140–160 + 20–27	200–210	105–115	37–43	40–48
pini	*P. sylvestris*	24	2·5–4·4	160–700	present	,,	,, ,,	400–700	140–260	190–270	100–180 + 25–52	140–220	70–120	31–46	38–57
fundatrix	,, ,,	14	3·2–4·0	310–620	absent	,,	,, ,,	460–660	180–240	210–280	100–160 + 27–46	150–180	70–100	36–59	40–70
pinihabitans	,, ,,	3	3·7–4·2	170–460	present	,,	present	620–650	250–330	250–280	120–160 + 31–37	150–160	85–90	41–44	45–67
escherichi	,, ,,	9	3·2–4·3	370–640	,,	,,	small	560–710	220–320	260–360	130–190 + 42–61	210–230	96–106	37–48	49–72
fundatrix	,, ,,	3	4·0–4·2	300–720	small–absent	,,	,,	620–670	240–260	250–270	170–180 + 35–45	200–210	100–105	53–60	58–64
brauni	*P. nigra*	30	2·5–3·8	fused	absent	present V broken	black patch	530–700	190–310	250–360	170–220 + 53–95	250–330	120–150	33–48	89–115
pinea	*P. sylvestris*	73	3·1–5·1	270–700	absent	present	large	500–740	220–360	280–400	140–230 + 43–71	210–290	110–170	47–65	137–220
schimitscheki	*P. nigra*	9	3·3–5·1	440–720	,,	,,	very small	630–860	270–350	300–380	120–200 + 52–70	290–360	130–165	45–60	86–111
pectinatae	*Abies*	32	2·8–5·0	180–300	,,	,,	present	330–550	130–210	160–240	140–200 + 40–63	210–270	80–105	43–58	121–155
costata	*Picea*	30	2·7–3·8	330–530	,,	,,	very small	330–470	120–200	180–260	150–210 + 19–35	190–260	105–125	35–44	23–35
pilicornis	,,	43	2·1–4·7	130–390	,,	,,	,, ,,	250–530	120–210	150–280	110–180 + 25–45	190–250	100–130	31–53	27–53
stroyani	,,	16	2·1–4·2	170–580	,,	,,	,, ,,	340–590	130–240	170–300	120–180 + 19–44	210–270	85–125	35–57	33–60
fundatrix	,,	7	3·5–4·6	200–420	,,	,,	,, ,,	420–530	130–180	130–180	130–160 + 17–30	210–250	100–115	38–49	35–54
bogdanowi	,,	30	2·4–5·0	240–870	,,	,,	absent	350–740	170–350	240–390	120–200 + 30–60	240–320	110–140	35–70	35–76
fundatrix	,,	2	3·4–3·8	420–560	,,	,,	,,	380–390	150–170	180–190	130–160 + 14–22	250–260	100–105	40–50	40–45
abieticola	*Abies*	22	3·8–7·8	490–990	,,	absent from V	very small	580–1100	280–590	330–630	230–290 + 44–90	270–360	120–150	53–81	20–46
juniperi	*Juniperus*	67	2·4–3·1	360–600	,,	absent	very small	250–370	95–180	160–280	150–230 + 40–70	120–170	60–90	31–58	13–28
fresai	*Juniperus Cupressus*	46	2·2–4·2	200–610	,,	,,	very small or absent	300–580	140–240	160–270	140–220 + 40–70	160–240	75–120	35–44	20–34
cupressi	*Cupressus Thuja*	88	1·8–3·2	200–570	,,	,,	very small or absent	240–450	100–200	130–210	130–160 + 25–46	130–180	70–100	35–44	19–35
tujafilina	*Thuja Callitris*	33	1·7–3·5	130–300	,,	,,	very small or absent	230–330	85–150	120–170	110–170 + 18–35	140–180	70–90	30–45	19–31

TABLE 1 (*contd.*)

	Hind tarsus segment 1 ventral length	Hind tarsus segment 2 length	Hind tibia length mm	Length of longest hair on: Third antennal segment	Length of longest hair on: Hind tibia	Length of longest hair on: abdominal tergites 3	Length of longest hair on: abdominal tergites 8	Number of hairs on second antennal segment	Number of hairs on sixth antennal segment: Base	Number of hairs on sixth antennal segment: sub-apical processus terminalis	accessory hairs on ultimate rostral segment	sub-genital plate	abdominal tergites 5	abdominal tergites 8	Number of secondary rhinaria on antennal segments III	IV	VI
piceae	130–210	360–470	2·3–5·1	27–80	44–90	5–26	45–130	9–16	9–17	6–11	12–17	48–76	6–17	9–17	0(–1)	0–1(–2)	0–2
fundatrix	170–200	390–430	3·9–4·3	40–70	55–90	9–18	70–150	5–11	11–16	6–8	8–12	47–120	6–12	7–13	0	0	0
kochiana	170–210	370–450	2·9–4·6	60–70	55–90	11–25	90–130	21–32	15–21	6–9	22–34	33–55	18–40	41–64	1–7	1–4	1–3
boerneri	150–210	360–510	2·0–3·0	24–70	50–70	14–33	60–100	7–13	6–11	4	5–7	19–56	16–36	18–31	0	0–1(–3)	(0–)1(–2)
laricis	110–180	270–390	1·5–2·9	40–80	65–125	35–120	90–180	5–9	4–7	(3–)4	5–7	18–29	20–42	13–23	0(–1)	0–1	1
acutirostris	100–140	240–310	2·4–3·2	70–95	90–120	40–65	110–180	6–8	9–12	4	6–9	18–37	4–7	12–18	0–2	0–1(–2)	(0–)1(–2)
fundatrix	100–130	240–250	1·9–2·1	75–90	105–125	85–90	140–160	6–8	7–9	4	6	26–34	18	17–21	0	0	1
pini	90–130	210–280	1·6–2·5	25–80	40–95	15–35	55–160	5–10	8–16	(3)–4	6–10	9–36	3–8	7–18	0–3	0–2	1(–2)
fundatrix	110–130	270–310	2·1–2·6	65–90	90–105	15–40	130–140	5–6	9–12	4	7	32–50	23–30	18–25	0–1	0–1	1–2
pinihabitans	120–150	260–320	2·5–2·7	110–150	170–190	140–180	140–160	7–8	8–10	4	4–6	28	40–50	20–24	0–2	1	1
escherichi	120–150	270–320	2·6–3·2	40–70	70–90	13–17	90–120	9–13	11–16	6–7	8–11	39–58	(5–)6	14–23	0–3	0–2	1(–3)
fundatrix	150–160	340–360	2·9–3·0	60–70	80–100	19–30	120–140	9–13	19–12	5–7	6–7	52–56	13–18	34–49	0(–1)	0–3	1(–2)
brauni	150–210	320–430	1·8–2·7	75–120	90–140	110–190	120–180	8–11	9–16	5–8	5–8	32–69	21–36	10–15	0–2	0–3	(0–)1(–2)
pinea	220–330	350–530	1·8–3·4	90–210	120–230	95–210	120–230	5–9	2–8	(3–)4(–5)	4–6	22–52	18–49	13–26	0(–4)	0(–2)	0(–2)
schimitscheki	170–220	320–380	2·2–3·0	70–120	110–150	45–100	95–130	9–13	6–9	(3–)4	6	50–58	26–65	27–60	0	0	0
pectinatae	190–260	360–450	1·2–2·0	45–110	110–190	30–130	130–200	5–8	5–8	(3–)4	5–8	30–50	36–56	23–38	0	0	0–1(–2)
costata	80–120	250–330	1·1–1·8	140–170	170–250	110–150	120–190	11–15	10–17	3–4	4(–5)	22–42	54–92	26–52	0	0–2	1–2
pilicornis	90–150	300–520	0·9–2·2	90–150	130–220	100–160	130–180	9–18	6–14	(3–)4	4–7	13–38	30–90	20–77	0–1	0–2	1(–2)
stroyani	110–160	340–450	1·6–2·4	60–90	60–105	60–80	100–150	14–22	11–18	4(–5)	6–9	32–65	40–100	14–35	(0–)1(–3)	1–3	1(–2)
fundatrix	110–150	320–400	1·6–2·3	70–100	100–135	90–105	120–150	9–16	6–10	(3–)4	6–8	43–56	65–95	23–40	0(–1)	(0–)1	1
bogdanowi	120–180	250–380	1·5–2·8	80–150	80–170	90–150	120–160	12–26	11–20	4(–5)	9–13	18–33	40–90	19–35	0–2	1–4	1(–2)
fundatrix	110–120	230–270	1·5–1·9	80–110	130–150	100–120	130–150	15–19	7–10	4	9	27	80–95	23–40	0–1	0–3	1
abieticola	130–180	380–500	3·4–5·4	190–300	150–330	160–270	190–360	12–24	9–14	3–4	7–13	30–50	70–85	29–43	0	1–4	1–2(–3)
juniperi	70–100	250–350	0·9–1·5	140–210	180–240	140–210	150–230	6–13	7–13	(2–)3(–4)	(3–)4(–5)	19–27	28–55	18–29	0	1–2	(0–)1(–2)
fresai	80–120	260–350	1·2–2·2	190–250	190–280	180–230	190–260	8–12	7–12	3	5–7	28–44	45–65	17–27	0	1–3	1(–2)
cupressi	80–120	240–310	1·0–1·7	150–220	180–240	120–200	170–220	6–13	4–7	(2–)3	2–4	22–30	30–50	16–31	0	(0–)1(–2)	(0–)1
tujafilina	60–100	200–280	0·8–1·6	110–170	140–240	100–180	120–100	7–12	8–14	3	5–8	19–33	50–70	19–26	0	(0–)1(–2)	1

Table 2

Biometric data for the alatae viviparae of the British species of *Cinara*

	Number of specimens	Body length	Diameter of siphuncular cone	Chitinised rim of primary rhinaria	Scleroites on abdominal tergites 2–5	Length of antennal segments III	Length of antennal segments IV	Length of antennal segments V	Length of antennal segments VI	Length of rostral segments 4	Length of rostral segments 5	Hind tarsus, first segment, dorsal length	Hind tarsus, first segment, ventral length	Hind tarsus, length of second segment	Length of hind tibia in mm
piceae	39	4·6–6·4	410–950	evident	small or absent	650–1230	290–420	460–580	190–210 + 50–70	300–370	130–150	65–100	170–220	450–520	4·3–6·3
kochiana	2	4·8–5·5	420–440	,,	,, ,, ,,	820–870	400–460	500–520	150–180 + 65–90	330–360	140–150	75–85	170–200	410–440	3·5–3·9
boerneri	9	3·4–4·6	250–450	present	small	550–750	250–330	340–420	150–190 + 25–40	160–190	90–105	90–120	180–220	440–510	2·6–3·2
laricis	35	3·1–4·8	300–650	,,	evident	500–750	220–340	280–420	110–160 + 25–45	160–200	85–110	60–90	130–180	320–400	2·2–3·0
acutirostris	10	3·2–4·1	360–530	evident	absent	560–650	210–290	260–320	120–160 + 35–50	190–230	110–135	35–55	100–130	250–310	2·5–3·2
pini	19	2·2–4·0	240–430	,,	,,	440–700	180–300	220–330	110–160 + 35–60	140–180	70–100	35–60	90–125	220–300	1·8–2·9
pinihabitans	17	3·0–4·4	240–370	,,	absent or v. small	550–750	200–340	250–370	120–160 + 35–50	130–170	80–100	45–75	110–160	260–330	2·3–2·9
escherichi	6	3·4–4·4	300–490	,,	,, ,, ,, ,,	610–700	250–320	320–360	140–170 + 40–55	200–220	95–110	45–75	130–155	300–360	2·9–3·2
brauni	7	2·8–3·7	440–620	,,	absent	520–650	220–290	270–320	170–220 + 60–90	260–300	130–145	80–110	160–190	350–410	2·1–2·5
pinea	40	3·3–5·3	370–730	,,	large	540–750	230–350	300–420	150–230 + 40–85	210–270	115–150	130–240	210–330	340–520	2·2–3·2
schimitscheki	4	3·4–4·6	450–580	narrow	small	590–730	270–310	290–340	150–190 + 40–70	310–330	120–170	70–120	160–200	320–360	2·4–3·1
pectinatae	5	3·3–5·0	150–400	present	small to large	300–550	160–200	180–230	160–200 + 29–50	190–250	90–100	150–180	190–270	380–450	1·4–2·2
costata	18	3·0–4·4	320–600	,,	v. small to absent	400–660	170–240	210–260	160–220 + 14–40	190–250	95–125	25–50	100–120	300–370	2·0–2·6
pilicornis	65	2·6–4·4	170–370	,,	absent	350–560	130–240	160–280	110–190 + 25–55	160–250	95–140	25–55	95–155	350–540	1·5–2·2
stroyani	2	2·0–3·8	130–390	evident	,,	360–480	140–200	160–250	120–170 + 25–35	180–240	95–120	35–55	100–125	320–340	1·4–2·1
bogdanowi	18	3·2–4·7	500–670	,,	,,	540–850	240–430	210–460	150–210 + 25–70	230–290	105–135	50–85	125–180	310–340	2·4–3·5
abieticola	23	5·1–7·5	500–990	absent	v. small	800–1150	380–620	380–650	250–320 + 45–75	290–370	130–165	30–55	140–200	420–570	4·3–6·7
juniperi	13	2·6–3·1	330–460	,,	,, ,,	360–460	130–210	190–270	180–230 + 40–75	130–160	60–95	20–35	85–110	320–370	1·6–1·9
fresai	34	2·7–4·2	250–600	,,	,, ,,	390–560	160–280	200–290	150–240 + 38–75	140–210	85–115	15–40	90–110	280–390	1·6–2·6
cupressi	14	2·2–3·5	300–450	,,	v. small or absent	350–550	160–220	180–230	140–190 + 30–50	130–170	75–100	20–35	80–110	280–350	1·4–2·2
tujafilina	22	2·5–4·1	170–380	,,	,, ,, ,, ,,	310–410	140–200	160–190	130–180 + 14–30	130–180	65–100	25–35	90–110	240–340	1·6–2·1

Table 2 (*contd.*)

	Length of longest hairs on: third antennal segment	hind tibia	Abdominal tergites 3	Abdominal tergites 8	Number of hairs on antennal segments II	VI Base	sub-apical processus terminalis	accessory hairs on rostral segment 4	Number of hairs on: Sub-genital plate	Abdominal tergites 5	Abdominal tergites 8	Secondary rhinaria on antennal segments III	IV	V	Other characters
piceae	40–65	45–75	35–80	80–140	11–18	12–20	7–11	10–17	60–110	6–14	12–20	5–15	1–3	1–2	Proximal 2/3 of hind femur pale
kochiana	55–70	45–75	30–60	80–100	21–32	15–22	5–8	24–34	33–55	18–40	43–61	11–14	2–5	2–4	
boerneri	25–40	50–80	20–40	75–100	8–13	7–9	4(–5)	4–8	35–48	19–24	16–32	7–13	1–4	1–3	Hind femur pale near base only
laricis	50–80	120–150	70–110	130–190	5–9	4–7	(3–)4	5–8	12–29	16–30	14–25	3–11	0–4	(0–)1(–2)	Hind tibiae with a pale area near base
acutirostris	70–100	110–130	65–100	120–160	6–8	9–13	4	6–8	24–38	5–6	10–17	1–6	1–4	1	,, ,, ,, ,, ,, ,, ,, ,,
pini	50–90	75–140	15–75	90–150	6–9	8–14	(3–)4(–5)	6–10	20–42	4–7	9–19	5–10	1–3	1–2	,, ,, ,, ,, ,, ,, ,, ,,
pinihabitans	120–160	170–210	120–200	150–200	6–9	7–11	(3–)4	4–5	17–29	18–38	11–22	1–8	1–4	1–2	,, ,, ,, ,, ,, ,, ,, ,,
escherichi	55–75	75–95	30–55	85–120	7–13	12–16	6–7	8–11	39–58	4–6	17–22	4–10	2–4	1–3	,, ,, ,, ,, ,, ,, ,, ,,
brauni	80–110	140–160	120–180	130–200	7–12	11–14	6–7	4–7	30–62	16–26	12–16	9–17	2–4	1–3	,, ,, ,, ,, ,, ,, ,, ,,
pinea	120–170	190–270	150–240	170–250	3–10	3–9	2–5	4–6	29–49	18–39	17–27	1–18	0–5	0–3	,, ,, ,, ,, ,, ,, ,, ,,
schimitscheki	120–150	150–170	70–110	110–150	7–13	7–8	(3–)4	6–7	50–70	50–58	35–43	0–9	0–1	1	Hind tibiae black
pectinatae	75–110	190–240	85–150	170–210	6–8	5–7	3–4	7–8	40–70	37–50	24–50	0–9	0–6	0–1	Hind tibiae dark near apex
costata	150–210	190–290	130–160	150–210	11–17	12–20	3–4	4–6	29–43	32–68	26–42	1–3	1–2	0–2	Fore-wing maculate near apex
pilicornis	80–160	180–270	105–160	125–220	8–20	6–13	3–4	4–6	18–42	24–49	21–53	1–8	0–3	1–2	Hind tibiae dark near apex
stroyani	70–105	95–180	55–110	100–200	9–18	9–17	4–5	5–8	22–37	24–49	16–32	6–9	1–3	1–2	Hind tibiae dark or with a very small dusky area near the base
bogdanowi	140–190	160–240	130–190	150–210	14–24	11–19	4	8–15	22–36	30–55	24–42	1–8	1–3	1	Hind tibia with pale area near base
abieticola	220–320	220–380	160–320	250–320	18–25	10–14	(3–)4	8–13	32–45	50–70	29–42	7–15	2–5	0–3	Hind tibiae black or with a small brown area near the base
juniperi	160–200	250–320	160–240	220–260	7–11	6–12	3(–4)	4	23–34	25–30	19–24	4–8	1–4	0–2	Hind tibiae black
fresai	190–250	280–360	140–210	190–260	10–14	8–14	(2–)3(–4)	5–8	26–40	60–70	16–27	6–11	1–4	1–2	,, ,, ,,
cupressi	160–220	230–350	120–200	160–260	7–10	5–6(–7)	(2–)3	2–5	22–40	60–70	15–25	3–6	1–3	1–3	Hind tibiae dark at base and apex
tujafilina	120–200	140–310	120–210	130–210	9–11	9–13	3(–4)	4–8	24–36	38–60	17–24	3–8	1–3	1–2	Hind tibiae dark at apex only

Table 3

Discriminants for the apterae viviparae of the British species of *Cinara*

	Third antennal segment							
	diameter of siphuncular cone	longest hair borne on it	Hind tibia: longest hair borne on it	Antennal segments V : VI	Rostral segments 4 : 5	Rostral segment 4: hind tarsal segment 1	Hind tarsal segment 2: rostral segment 4	Hi tar segm 2 :
piceae	1·0–3·2	7·5–31	36–84	1·6–2·1	2·2–3·0	1·8–2·5	1·1–1·3	2·2-
fundatrix	1·8–2·4	12–23	57–79	1·6–1·9	2·2–2·9	1·6–2·0	1·1–1·4	2·0-
kochiana	1·6–2·2	8·5–15	38–78	1·7–2·2	2·4–3·0	1·8–2·2	1·0–1·2	2·0-
boerneri	1·8–3·5	7·8–25	32–56	1·4–1·9	1·7–2·3	0·9–1·3	1·8–2·6	2·1-
laricis	0·8–2·1	6·8–13	17–34	1·4–2·5	1·2–2·2	1·0–1·7	1·4–2·1	2·0-
acutirostris	0·8–1·6	6·6–9·3	24–33	1·3–1·8	1·8–2·3	1·6–2·1	1·0–1·4	2·0-
fundatrix	1·2–1·6	5·0–6·0	16–19	1·1–1·4	1·7–1·9	1·6–2·0	1·1–1·3	1·9-
pini	0·7–2·5	7·7–15	23–42	1·1–1·9	1·7–2·3	1·3–1·9	1·2–1·7	2·1-
fundatrix	0·9–1·6	6·6–11	22–39	1·2–1·8	1·7–2·2	1·2–1·6	1·5–1·8	1·9-
pinihabitans	1·2–1·6	4·4–6·0	14–16	1·4–1·8	1·7–1·9	1·0–1·3	1·7–2·3	2·1-
escherichi	1·1–1·7	9·5–15	30–46	1·4–1·8	2·0–2·4	1·1–1·7	1·2–1·5	2·0-
fundatrix	0·9–1·5	9·5–11	31–34	1·1–1·3	2·0–2·1	1·3–1·5	1·6–1·8	2·2-
brauni	0·8–1·2	4·5–9·5	16–25	0·9–1·3	1·8–2·5	1·5–2·0	1·0–1·5	1·9-
pinea	0·8–2·1	3·2–6·5	12–20	1·1–1·7	1·6–2·2	0·8–1·2	1·4–2·0	1·4-
schimitscheki	1·0–1·5	5·9–12	15–27	1·3–1·5	2·1–2·4	1·4–1·8	0·9–1·2	1·6-
pectinatae	1·4–2·2	3·4–11	7–18	0·7–1·0	2·4–2·9	1·0–1·2	1·5–1·9	1·7-
costata	0·7–1·2	2·0–2·8	6–9	0·8–1·2	1·8–2·4	1·7–2·5	1·2–1·6	2·6-
pilicornis	1·2–2·2	2·3–4·5	7–12	1·0–1·4	1·8–2·1	1·4–2·3	1·5–2·4	2·9-
stroyani	0·6–2·3	4·2–7·5	17–29	1·1–1·4	2·1–2·5	1·5–2·3	1·2–1·9	2·0-
fundatrix	1·2–2·3	4·7–6·7	14–21	0·9–1·4	2·2–2·4	1·7–2·1	1·4–1·6	2·6-
bogdanowi	0·6–1·9	3·2–6·2	14–27	1·0–1·7	1·9–2·6	1·6–2·3	0·9–1·3	1·9-
fundatrix	0·7–0·9	3·6–4·7	11–18	1·0–1·5	2·3–2·6	1·8–2·3	0·9–1·3	2·1-
abieticola	0·9–1·9	2·6–4·4	12–29	1·2–1·8	2·1–2·6	1·8–2·4	1·2–1·5	2·5-
juniperi	0·5–1·1	1·5–2·3	4–8·3	0·7–1·1	1·6–2·1	1·4–2·1	1·8–2·4	3·1-
fresai	0·7–1·7	1·7–2·4	6–9	0·7–1·1	1·6–2·4	1·8–2·2	1·3–1·7	2·6-
cupressi	1·1–1·7	1·6–2·5	5–8	0·7–1·1	1·5–2·1	1·4–1·9	1·5–2·0	2·5-
tujafilina	0·8–1·5	1·6–2·5	5–9	0·8–1·1	1·8–2·2	1·6–2·1	1·4–1·7	2·6-

TABLE 4

Discriminants for the alatae viviparae of the British species of *Cinara*

	Third antennal segment: diameter of siphuncular cone	Third antennal segment: longest hair borne on it	Hind tibia: longest hair borne on it	Antennal segments V : VI	Rostral segments 4 : 5	Rostral segment 4: hind tarsal segment 1	Hind tarsal segment 2: rostral segment 4	Hind tarsal segments 2 : 1
piceae	1·1–2·1	17–26	65–120	1·8–2·3	2·2–2·8	1·5–1·9	1·3–1·6	2·2–2·7
kochiana	1·9–2·0	11–15	50–75	1·9–2·3	2·3–2·4	1·7–2·0	1·2–1·3	2·1–2·4
boerneri	1·3–2·6	17–25	38–60	1·7–2·1	1·7–2·1	0·8–1·0	2·4–2·8	2·3–2·7
laricis	1·0–1·9	7–12	16–23	1·7–2·7	1·6–2·1	1·0–1·3	1·8–2·4	2·1–2·7
acutirostris	1·1–1·6	6–8·5	20–29	1·4–1·9	1·6–1·8	1·7–2·1	1·1–1·4	2·3–2·6
pini	1·3–2·3	5·5–9	14–25	1·2–1·7	1·6–2·2	1·2–1·6	1·5–1·8	2·2–2·7
pinihabitans	1·8–2·6	3·5–6	12–16	1·5–2·0	1·5–1·9	1·0–1·3	1·7–2·2	2·0–2·4
escherichi	1·3–2·1	8·5–12	32–38	1·5–1·9	2·0–2·2	1·3–1·6	1·4–1·7	2·1–2·6
brauni	1·0–1·3	6·5–8	14–16	1·0–1·2	1·9–2·3	1·5–1·8	1·2–1·5	2·0–2·3
pinea	0·9–1·7	3·5–6	9·5–16	1·1–1·7	1·6–2·1	0·7–1·1	1·5–2·1	1·4–2·0
schimitscheki	1·2–1·5	4–6	15–19	1·2–1·5	1·9–2·6	1·6–2·0	1·0–1·2	1·8–2·0
pectinatae	1·1–2·0	3–6·5	6–12	0·8–1·1	2·1–2·8	0·8–1·1	1·7–2·1	1·7–2·1
costata	0·8–1·5	2·4–3·3	7·5–10	0·9–1·3	1·7–2·2	1·7–2·3	1·3–1·7	2·8–3·5
pilicornis	1·2–2·2	3–5	6·5–11	0·9–1·4	1·6–2·1	1·4–2·0	1·8–2·6	3·2–4·4
stroyani	1·2–2·2	3·7–6·1	9·5–18	1·0–1·3	1·9–2·2	1·6–2·2	1·6–1·9	3·1–3·5
bogdanowi	0·9–1·6	2·9–5·1	11–23	1·5–1·9	1·9–2·6	1·5–1·9	1·1–1·5	2·2–2·7
abieticola	1·1–1·9	2·9–4·5	14–24	1·3–1·8	2·0–2·5	1·6–2·5	1·4–1·6	2·6–3·5
juniperi	0·9–1·2	1·9–2·6	5·7–6·8	0·7–1·1	1·5–2·0	1·4–1·6	2·0–2·8	3·3–4·0
fresai	0·8–1·6	1·8–2·4	5·8–7·7	0·8–1·1	1·6–2·2	1·6–2·1	1·6–2·1	2·9–3·5
cupressi	1·0–1·5	2·1–2·6	5·6–6·8	0·9–1·2	1·5–1·9	1·2–1·7	2·0–2·4	2·8–3·5
tujafilina	1·0–1·9	2·0–2·9	6·3–8·6	0·9–1·1	1·5–2·2	1·2–1·8	1·6–2·2	2·6–3·3

TABLE 5

Biometric and other data for the sexuales of the British species of *Cinara*

	Available subgeneric name	Condition	Number examined	Males: Secondary rhinaria on antennal segments III	IV	V	VI	Pseudosensoria on hind tibiae o oviparae
piceae	*Mecinaria*	unknown		—	—	—	—	absent or inconspicu
kochiana	*Laricaria*	alate	1	90–98	18–20	12–15	0	numerous, inconspicuous
boerneri	*Cinarellia*	,,	15	82–111	19–39	13–20	9–14	numerous
laricis	*Cinaria*	,,	8	60–110	18–31	11–19	6–11	numerous, inconspicuous
acutirostris	*Cinara*	apterous	2	0–2	5–8	2–5	7–8	absent
pini	,,	alate	0	33–37	7–11	2–5	0	inconspicuous
pini subsp. ***montanicola***	,,	apterous	3	3–27	3–8	2–5	0	absent or inconspicu
pinihabitans	,,	alate	1	91–116	20–30	7–8	0	conspicuous
escherichi	,,	? apterous	0	—	—	—	—	unknown
brauni	*Subcinara*	unknown	0	—	—	—	—	,,
pinea	*Cinarella*	alate	3	45–63	11–24	7–10	0	numerous, conspicuo
schimitscheki	,,	unknown	0	—	—	—	—	unknown
pectinatae	*Buchneria*	alate	1	56–68	14–27	12–14	4–5	conspicuous
costata	*Lachniella*	alate	0	38–60	13–25	6–12	0	conspicuous, tibia swollen
pilicornis	*Cinaropsis*	,,	2	45–58	13–18	3–4	0	numerous, conspicuo
stroyani	,,	unknown	0	—	—	—	—	indistinct
bogdanowi	*Pityaria*	alate	1	46–82	12–26	4–15	0	numerous, conspicuo
abieticola	*Dinolachnus*	,,	2	102–130	35–39	14–18	0	,, ,,
juniperi	*Cupressobium*	unknown	0	—	—	—	—	unknown
fresai	,,	,,	0	—	—	—	—	,,
cupressi	,,	alate	3	22–39	8–12	6–7	0	numerous, conspicuo
tujafilina	,,	unknown	0	—	—	—	—	unknown

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By R. W. CROSSKEY & B. V. PETERSON

CONTENTS

SYNOPSIS

An alphabetical catalogue is given of the 43 species and infraspecific taxa of Simuliidae described by N. Baranov, with an account of all existing type-material on which the names are based. Sixteen lectotypes are designated. Each species-group taxon is assigned to its correct genus-group segregate after type-examination, and previously established synonymies are given; no new synonyms are involved. A complete bibliography of Baranov's works on Simuliidae is included, although most of them are not taxonomic.

INTRODUCTION

The extensive taxonomic and other investigations on the European Simuliidae made in the past 25 years, since the last war, have taken little account of the work of Mr Nikola Baranov between 1924 and 1942 on the black-fly fauna of Yugoslavia, and even Rubzov's (1959–1964) comprehensive monograph of the Palaearctic Simuliidae mentions only nine of the 43 species-group taxa that Baranov described. It is quite likely that some of Baranov's names apply to, and have priority over, taxa and names that have been proposed recently by other authors, though it will be some time before all the various synonymies among European black-flies can be unmasked.

The European literature of simuliidology is bedevilled with nomenclatural difficulties arising from too much neglect of the early names, misidentification through failure to study the types, and a lack of attention on the part of too many workers to the elements of nomenclature. Before many of the problems of identity and synonymy can be resolved it will be necessary to make extensive studies of the types, and a preliminary need is for an up-to-date catalogue of Palaearctic black-flies which includes the basic data on all the primary types and their whereabouts. This is being prepared at the moment by one of us (R.W.C.), and the present conjoint paper on Baranov's Simuliidae has two main purposes: to make known to other simuliidologists what material still exists in Baranov's collection and to clarify a number of matters concerning Baranov's Simuliidae in advance of the projected catalogue.

Most of Baranov's work in Yugoslavia during the 1920's and 1930's was concerned with the infamous 'Golubatz fly', *Simulium columbaczense* (Schönbauer) [name now a synonym of *S. colombaschense* (Fabricius)], which breeds along a stretch of the river Danube and becomes an appalling and notorious biting pest in periodical outbreaks, and Baranov himself well documented his extensive studies on this pest (see references). It was as a by-product from this main work that Baranov discovered and named the various species, subspecies, forms and races of *Simulium* Latreille s.l. (numbering 43 taxa in all) that he described; all were found in Yugoslavia and most were described from the states of Serbia and Macedonia.

Baranov made a personal collection of Yugoslav Simuliidae which consisted both of pinned adult flies (many of them reared from pupae and kept with their associated pupal pelts) and of adults and early stages preserved in alcohol, and this collection originally contained all the type-specimens on which his taxa were based. Unfortunately part of the collection, including all of the alcohol material, was lost at the end of the second world war, when Baranov was experiencing great difficulties as a displaced person, and has never been found again. (Our information on this point was obtained from Mr Baranov himself, both from conversations during the preparation of this paper and from a letter that he wrote to Mr Guy Shewell, of the Division of Entomology, Canada Department of Agriculture, in 1954 when the purchase of the remainder of his collection was being negotiated.)

The surviving part of Baranov's collection consists of adult material, often with associated pupal pelts, and is in the Canadian National Collection (hereafter abbreviated CNC). It was bought from Baranov in 1954 by the Canada Department of Agriculture and is now housed as part of the CNC in the Entomology Research Institute at Ottawa, Canada. All extant types of Baranov's taxa of Simuliidae are in this collection except for some paralectotypes deposited in the British Museum (Natural History) (text-abbreviation: BMNH) by an exchange made whilst this paper was in preparation. Baranov himself did not exchange specimens with other workers or deposit 'cotypes' in other museums (Baranov, pers. comm., and i. litt. to Shewell as follows: 'Your assumption that in no other collection [besides his own] these cotypes are contained is correct. Since I had to stop my work before I had finished I never started to exchange material with anybody in this line [Simuliidology]').

Baranov's letter to Shewell, referred to above and dated 4th March 1954, contains some helpful and definite information on the fate of several of the types that are lost, and we have accordingly cited this letter from time to time in the body of this paper: the text notation 'Baranov i. litt. to Shewell' refers always to this particular letter.

Baranov described 43 nominal taxa of species-group Simuliidae, and five genus-group taxa. The latter, viz. *Danubiosimulium*, *Echinosimulium*, *Pseudodagmia*, *Pseudonevermannia* and *Pseudosimulium*, are discussed by Stone (1963) and are not considered further in this paper. Baranov's collection in Ottawa contains specimens labelled as primary types of seven species-group entities, in addition to the still extant types of the described taxa, but we are now convinced that the seven names attached to these extra 'types' were never actually published (since they are

manuscript names we are not recording them in print). Baranov (i. litt. to Shewell), when asked about these names in 1954, implied that they had been published although he was not able to recall the references, and because of the possibility that they could have appeared in print in one of the little-known Yugoslav journals and been overlooked we have made extra-careful searches for them. No trace of any of these seven names has been found from a page-by-page search through all the works on Simuliidae of which Baranov was sole or conjoint author, and our bibliography of these works is, we believe, complete; we conclude, and Mr Baranov (personal communication with R.W.C.) now thinks this must be so, that Baranov had intended to publish the seven names but never actually did so (either because no manuscripts on the seven taxa were completed or because they went astray after completion, perhaps during the difficult war years). Of the 43 published taxa it should be explained that, for reasons given where appropriate in the text, we regard *Odagmia ruficornis* and *O. ruficornis prima* as names applying to a single nominal taxon, and likewise *Wilhelmia stylata* and *W. stylata prima* as likewise applying to one taxon only; three of Baranov's names, viz. *barensis, intermedia* and *mazedonica* were overlooked by Smart (1945) and omitted from his catalogue of world Simuliidae.

When originally described Baronov's 43 taxa comprised 11 species, six subspecies, 24 forms (plus two uses of f. *prima* for the nominate subdivision of species *ruficornis* and *stylata*) and two ecological races. Some of these taxa were well and formally described, but for others there is only the bare minimum of descriptive matter—often not set out as a formal description—to make the names nomenclaturally available. Nevertheless all of them have, in our opinion, status in nomenclature (none can be clearly interpreted as infrasubspecific in the meaning of the *International Code of Zoological Nomenclature*, 1961, for the reasons given below), and are available names (though some, as annotated in the text, are primary homonyms or secondarily homonymous in *Simulium* s.l.). Baranov himself fixed types for all his taxa, and intended that his various forms and races should have status in nomenclature as much as his subspecies and species. He divided species either into subspecies or into forms (or in the case of *S. columbaczense* into geographically separate ecological races), but his subspecies were never themselves divided into forms, and there is no instance in which any of his forms is infrasubspecific; furthermore the form names were bestowed on geographically allopatric entities (see, for instance, Baranov's 1937*a* segregation of forms in the 'Vardar-Formenkomplex' and the 'Morava-Donau-Formenkomplex') not different in kind from his subspecies, and indeed he sometimes referred to his subspecies as forms without discrimination. Hence all of his form names, as none is clearly infrasubspecific, have nomenclatural status under the *Code* and are based upon the types. Similarly the two entities originally described as ecological races (*litorale* and *profundale*) are here deemed to have status under the *Code* since these names cannot be interpreted as infrasubspecific (because the specific taxon to which they belong was not divided into subspecies, because Baranov himself variously referred to them as races or forms, and because they were described as geographically as well as ecologically separated taxa).

One other matter concerning Baranov's form names requires mentioning.

Baranov used each of the names *prima* and *secunda* five times for supposedly distinct forms within five species, all of the uses of these names being published in a single paper (Baranov, 1926*b*). In practice the existence of five *prima* homonyms and five *secunda* homonyms creates no difficulty, because (with the exception of one use by Rubzov, 1962) later authors have not regarded Baranov's *prima* and *secunda* entities as having taxonomic validity; Smart (1945) merely listed them under the appropriate species name. In the present paper we draw attention to the homonymy and point out that future authors may need to provide replacement names in the improbable event that they should consider some of Baranov's *prima* and *secunda* forms worthy of named rank. There is as yet no determined senior homonym among the uses of *prima*, but Rubzov (1962 : 412) has given *Wilhelmia equina secunda* Baranov full specific rank and we consider that Rubzov's citation determines which of the five uses of *secunda* is to be held as the senior homonym.

In the body of this paper we enumerate all of Baranov's described species-group taxa in alphabetical order of their original combinations and give details of the types. For each name the entry is arranged to show the following information in the order indicated:-

> Name; author; date and page reference of original publication; status and sex of primary type (or syntypes); present lectotype designation (if necessary); locality and date of primary type; type-depository.
>
> Number and sex of paralectotypes or paratypes, with data and depository information as for primary types.
>
> Explanatory comments or annotations when necessary.
>
> Genus-group assignment for each name where possible, and annotations on correct placement.

For the localities we have always cited a larger unit first, i.e. state before town or village, town before stream name, and we have always indicated the state (e.g. Serbia or Macedonia) for each locality even though Baranov often omitted this information from the original publication. Baranov, in publication and on labels, used the spelling Skoplje for one of his important localities, but we have thought it better to use the English spelling Skopje. Baranov variously used either the Croatian spelling Golubac or the German spelling Golubaz; we have consistently used the former spelling, which accords with English transliteration from Serbian.

Whilst working through Baranov's collection in conjunction with the publications containing his descriptions we have found a number of anomalies. Most of the specimens in the collection bear Baranov's labels either as 'Typus' or as 'Cotypus', but there is not always complete agreement between the status indicated by Baranov and that which is apparent from the description; there are some discrepancies between the sex of the specimen labelled as type and that described in publication, and there are several instances in which specimens labelled as types by Baranov cannot have any type-status because they were not collected (as indicated by the data labels) until some time after the description had been published. We have judged each case of discrepancy individually, and have determined the status of types in doubtful cases after careful scrutiny of the original publications; in some

instances it has seemed reasonable to accept certain specimens as being original syntypes in the light of some piece of information contained somewhere in Baranov's text, but in other instances it has been considered that the evidence does not warrant inclusion of certain specimens in the syntypic series (e.g. too great a conflict between cited dates or localities or sex taken in combination). Any discrepancies between specimens and descriptions of the kind mentioned have been fully annotated. In the case of syntypic series we have ordinarily labelled and designated the specimen labelled 'Typus' by Baranov as the lectotype, provided there is no discrepancy (no lectotype designations have previously been published for Baranov's simuliid taxa and all lectotypes mentioned are newly designated).

Baranov published several figures of the male hypopygium of various Simuliidae, including some of his new taxa, but all of his slides are believed lost; there are none with the main collection in CNC.

Baranov's species-group taxa of Simuliidae were described in nine taxonomic papers, but Baranov published many other papers on the Simuliidae of which some contain keys and other taxonomic information. No complete bibliography of Baranov's works on black-flies has up to now been published, even Rubzov's (1959–1964) monograph including little more than half the relevant references, so we have thought it useful to bring together such a bibliography in the present paper. Our attempts to trace the manuscript names (already referred to) in print obliged us to examine every one of Baranov's works on the Simuliidae, many in obscure publications overlooked by recording and abstracting journals, and rather than 'waste' the bibliographic information obtained we have assembled it as a full bibliography in the references at the end of this paper. To the best of our knowledge this bibliography is complete.

The bibliography contains in all 34 publications of Baranov concerned with Simuliidae (30 in which he was sole author and 4 in which he was co-author). Out of this total of works only 11 titles are to be found in the *Zoological Record*, and only 20 are recorded in the *Review of Applied Entomology*, Series B, Medical & Veterinary (17 with abstracts and three by title only). This does not, however, reflect badly on these recording publications, for two reasons: firstly, several of the publications are in the nature of instruction pamphlets or semi-popular accounts of the Golubatz fly (not strictly scientific papers), and, secondly, many of the papers were published in local Yugoslav journals which are either not held in any British library or are held in incomplete sets (e.g. lacking volumes for the second world war years). Although so many of the papers are in rather inaccessible publications it has been possible for one of us (R.W.C.) to see thirty of them in the original, and the remaining four in photocopy, by bringing copies together from the following sources: personal gift and loan from Mr Baranov himself of a few publications still remaining in his possession; library holdings of British Museum (Natural History), Commonwealth Institute of Entomology (which holds many reprints, including most of the important papers published in *Veterinarski Arhiv*), and of the Commonwealth Bureau of Animal Health, Weybridge; and photocopies from the Nacionalna i Sveučilišna Biblioteka, Zagreb, the library of the Veterinary Faculty, Institute of Medical Researches, Belgrade, and the library of the U.S. Department of Agricul-

ture, Washington, D.C. References from all sources have been cross-checked against a manuscript of his simuliid papers prepared by Baranov himself in the 1950's (copy supplied to us by Dr Alan Stone), and with Mr Baranov's recollections at the present time of his various publications. The manuscript list referred to was prepared by Mr Baranov largely from recollection, when he was living in Pakistan without access to literature, and as a result there are a few minor omissions and errors; nevertheless it has been of such immense value to us in providing leads to many of the lesser known works (which are not cited in the recording journals and could easily have been overlooked) that we take this opportunity of recording our indebtedness to this list.

Finally in this introduction we should note that we have consistently used the spelling Baranov with terminal 'v' throughout the paper, though Baranov sometimes used the alternative 'ff' ending to his name (especially in German-language publications).

ACKNOWLEDGEMENTS

It gives us great pleasure to acknowledge the generous help that we have received from Mr Nikola Baranov, including valuable information on his work in Yugoslavia and on his simuliid collections and publications, and the generous gift or loan of copies of some of his works. One of us (R.W.C.) is also most grateful to Mr and Mrs Baranov for their kindness and hospitality during a visit (in January, 1971) to their home in Shepherd's Bush, West London, when many of the points that had arisen in the preparation of this paper were helpfully discussed.

We are grateful also to the following persons who helped us by providing photocopies of various publications: Mr Milutin Ivanušić, National and University Library, Zagreb; Dr Alan Stone, U.S. Department of Agriculture, Washington, D.C.; and Dr Vera Zivković, Veterinary Faculty, Institute of Medical Researches, Belgrade. We thank Dr Zivković also for helpful information on Baranov's publications and for confirming that no specimens from Baranov's material are in Yugoslav collections. Dr Curtis Sabrosky very kindly supplied us with information on Baranov's son which enabled us, in turn, to establish contact with Mr and Mrs Baranov. Miss Pamela Gilbert, of the Department of Entomology Library, British Museum (Natural History), helped us considerably with the unusually obscure references involved in this work, and in obtaining photocopies from other libraries, and for this we are grateful.

SHORT BIOGRAPHY OF N. BARANOV

Nikola Baranov was born at Orël in Russia in 1887. He grew up in Nishni Novgorod, where his father was director of the grammar school, and graduated from the Natural History Faculty of the University of Moscow. He then specialized in applied entomology, studying under Professor Kulagin at the Agricultural Academy in Petrovsko Rasumovsko (near Moscow), and—after completing the course in applied entomology—was appointed entomologist to the Agricultural Station at Kursk in southern Russia. Here he was working as an agricultural entomologist at the time of the Russian revolution in 1917.

In the autumn of 1919 Baranov was forced to leave Kursk because of the civil war. He went first to the Crimea, but decided to leave Russia finally from there in the autumn of 1920. He settled in Yugoslavia, and in May 1921 was appointed to the staff of the Agricultural Station (Poljoprivredne Stanica) at Topčider, Belgrade, where he started entomological work on a variety of agricultural pest problems. He soon began to work in particular on the Acridoidea, especially the Moroccan locust pest *Dociostaurus maroccanus* (Thunberg). His first scientific papers appeared in 1924 and 1925 and were concerned with the morphological variability and natural enemies of this locust, and with the classification of Serbian Acridoidea by using the male genitalia. As a result of studying the dipterous parasites of *Dociostaurus* he acquired an interest in Sarcophagidae and Tachinidae, of which (in later years) he described many new genera and species (see Sabrosky & Crosskey, 1969, 1970).

After five years at the Topčider station Baranov took the post of entomologist at the Institute of Hygiene in Skopje (Macedonia) in 1926, from where he was shortly transferred to the Institute of Hygiene at Zagreb (Croatia) when this was newly opened in 1928. In the following year a lady assistant from Vienna was appointed to help Baranov with his entomological work, and they were married in 1931; from this time on Baranov was greatly aided in his work by Mrs Baranov, and it is of special interest to note that it was she who drew nearly all the figures in his papers and put into German those papers which he published in this language. Baranov began to work upon the Simuliidae whilst still at Topčider because of the great importance as a livestock pest of the Golubatz fly (*Simulium colombaschense* (Fabricius), syn. *columbaczense* Schönbauer), and later whilst at the Institutes of Hygiene at Skopje and Zagreb he extended his interests to the whole Yugoslav simuliid fauna; during the 1930's the Veterinary Faculty at Zagreb supported his well documented studies on the Golubatz fly (for further information see Introduction). Baranov's duties with the Institutes of Hygiene were many and varied and the Golubatz fly was only one aspect; in addition he worked on domestic flies of hygienic importance, including the control of house-flies and malarial mosquitoes. For many years, in conjunction with the Agricultural Station in Zagreb, he helped to organize the control measures against insect pests of olive trees in the coastal areas of Dalmatia.

Baranov continued to work with the Institute of Hygiene at Zagreb until 1944, when he left Yugoslavia and his entomological work ended. Immediately after the second world war Baranov was, for a time, a displaced person, but luckily throughout this difficult period he was able to keep most of his entomological collections intact, and to take them with him in 1948 to the newly-formed state of Pakistan (where Mrs Baranov was offered employment and Baranov was able to settle). The collections were later sold, the Simuliidae (plus some Culicidae and Muscidae) going to the Canada Department of Agriculture, Ottawa in 1954, and the Tachinidae and Sarcophagidae to the United States National Museum, Washington, D.C. in 1960.

In 1962 Baranov came to England, where—now aged 84—he is living in retirement in London.

We take this opportunity of thanking Mr and Mrs Baranov for providing much

of the information for this short account and of extending our best wishes to them for the future.

BARANOV'S NOMINAL SPECIES-GROUP TAXA OF SIMULIIDAE AND THEIR TYPES

Danubiosimulium columbaczense (Schoenbauer), form ***intermedia*** Baranov, 1939*a* : **110**, 118–120 (Croatian), 122–125 (German). Syntypes ♂, ♀, pupae, larvae, YUGOSLAVIA: Serbia, R. Danube, near Sip Canal, iv. 1938 (not located, presumed lost).

Baranov proposed the name *intermedia* for a form of *columbaczense* (Schoenbauer) in which the adult flies were intermediate between those of *columbaczense* race *litorale* Baranov and *columbaczense* race *profundale* (being large like the former but having a metallic sheen like the latter) and emerged from the Danube in the geographical area of the Sip Canal earlier in the year than race *litorale*. Apart from adults Baranov mentioned larvae and pupae. The work containing the name *intermedia* has scattered mentions of characteristics differentiating the taxon, although there is no formal description, and the name is nomenclaturally available. No original type-material or any other material pertaining to *intermedia* has been located and the syntypic specimens are presumed lost.

The name *intermedia* appears in the *Rev. app. Ent.* (B) **27** : 85–86 but was overlooked by Smart (1945) and omitted from his catalogue of world Simuliidae. It does not appear in Rubzov (1959–1964). Probably no present day taxonomist would regard *intermedia* as a taxonomic entity requiring a formal name and the name is best regarded simply as a synonym of *Simulium columbaczense* (Schoenbauer) (=*S. colombaschense* (Fabricius)). It is a junior secondary homonym in *Simulium* s.l. of *S. intermedium* Roubaud, 1906, and would in any case, therefore, require a replacement name if applied to a valid taxon.

Echinosimulium echinatum Baranov, 1938*a* : 313 (Croatian), 323 (German). Holotype pupa, YUGOSLAVIA: R. Danube (not located and presumed lost).

Baranov (1938*a*) described the larva and the pupa of this species and stated (Croatian text, p. 316, German text, p. 325) that the pupal description was based on the holotype. It is known that Baranov made slides of larval specimens for the larval description but these are not with the Baronov collection in CNC and are presumed lost; if later located, the larvae will have paratype status.

Rubzov (1962 : 259) places *echinatum* in the segregate *Titanopteryx* Enderlein (=*Byssodon* Enderlein) and this placement is undoubtedly correct, though whether subspecific status within *maculatum* Meigen is justified appears doubtful.

Nevermannia angustitarsis (Lundström), form ***mazedonica*** Baranov, 1926*b* : 185, 193. Syntypes ♀, YUGOSLAVIA: Macedonia, Hanrijevo near Skopje; Serbia, Tuman (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). A ♀ specimen from Skopje, 4.xi.1926, is in Baranov's collection but has no type-status, as it was collected after publication of the name.

The name remains enigmatic. Smart (1945) omitted the name *mazedonica* from his world catalogue of Simuliidae by oversight.

Nevermannia aurea (Fries), form ***prima*** Baranov, 1926*b* : 185, 192. Syntypes ♂, ♀, pupae, larvae, YUGOSLAVIA: Macedonia, Hanrijevo near Skopje (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell).

The name remains enigmatic and is a secondary homonym in *Simulium* s.l. of *prima* Baranov (1926*b*, forms of *equina* L., *ornata* Meigen, *ruficornis* Baranov and *stylata* Baranov).

Nevermannia aurea (Fries), form ***secunda*** Baranov, 1926*b* : 185, 192. Syntypes ♂, YUGOSLAVIA: Macedonia, Hanrijevo near Skopje (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell); the original publication cited only the adult male, but it is possible that Baranov also had the female and immature stages at the time of description (as he did for *aurea* f. *prima*, see above). The name remains enigmatic and is a secondary homonym in *Simulium* s.l. of *secunda* Baranov (1926*b*, forms of *equina* L., *ornata* Meigen, *ruficornis* Baranov and *stylata* Baranov).

Odagmia croatica Baranov, 1937*a* : 263 (Croatian), 274 (German). LECTOTYPE ♀, by present designation, YUGOSLAVIA: Croatia, Zagreb, 23.iii.1931 (CNC).

Paralectotypes: 1 ♂, 3 ♀, same data as lectotype (♂, 2 ♀ in CNC; one ♀ in BMNH).

Baranov did not mention the number of specimens in the Croatian description (pp. 263–264), but mentioned one male and four females at end of the German description (p. 275); the type-specimens cited above therefore comprise the whole type-series. The paralectotypes are in poor condition and the male is on the same mount as one of the females.

O. croatica is not placed by Rubzov (1959–1964); it is here confirmed from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 503) gives the publication date of this name as 1936 in error.

Odagmia croatica Baranov, form ***decolorata*** Baranov, 1937*a* : 264 (Croatian), 276 (German). LECTOTYPE ♀, by present designation, YUGOSLAVIA: Croatia, Zagreb, 30.iii.1931 (CNC).

Paralectotypes: 3 ♂, 3 ♀, same data as lectotype (2 ♂, 2 ♀ in CNC; 1 ♂, 1 ♀ in BMNH).

Baranov mentioned both sexes in the original descriptions but did not state the number of specimens; all the above-listed specimens are considered to be original syntypes as their data fully conforms with the original publication.

O. croatica f. *decolorata* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 503) gives the publication date of this name as 1936 in error.

Odagmia croatica Baranov, form ***nigrina*** Baranov, 1937*a* : 264 (Croatian), 275 (German). LECTOTYPE ♀, by present designation, YUGOSLAVIA: Croatia, Zagreb, 23.iii.1931 (CNC).

Paralectotypes: 2 ♂, 2 ♀, same data as lectotype (one of each sex in CNC and BMNH).

Baranov did not mention the number of specimens in the Croatian description (p. 264), but mentioned two males and three females at the end of the German description (p. 276); the type-specimens cited above therefore comprise the whole type-series. All of them lack the abdomen.

O. croatica f. *nigrina* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 509) gives the publication date of this name as 1936 in error.

Odagmia (Pseudodagmia) kondici Baranov, 1926*a* : 161. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, Tuman, 9.vi.1925 (CNC).

Paralectotypes: 3 ♀, same data as lectotype, on same mount (CNC). 1 pupal exuvium, YUGOSLAVIA: Serbia, Golubac, 27.v.1925 (CNC).

Baranov described this species from both sexes, pupa and larva. We have not located any male or larval syntypes and presume these to be lost. The CNC collection contains (from Baranov's collection) specimens of *kondici* from Macedonia (2 ♂ and 6 ♀ from Skopje and one ♀ from Treska) but these specimens have no type-status; they were collected in November, 1926 (Treska specimen) and July, 1927 (Skopje specimens), after the original description had been published.

This species is assigned by Rubzov (1963 : 506), under the mis-spelling *condici*, to *Tetisimulium* Rubzov, and we confirm this placement after examination of the lectotype.

Odagmia ornata (Meigen), form ***anderliceki*** Baranov, 1937*a* : 263 (Croatian), 274 (German). Holotype ♂, YUGOSLAVIA: Serbia, Golubac, Dedinje stream, 24.v.1936 (CNC).

Paratypes: 1 ♂, 6 ♀, same data as holotype (CNC). 3 ♂, 3 ♀, same data as holotype, except only year date 1936 (2 ♂, 2 ♀ in CNC; 1 ♂, 1 ♀ in BMNH). 5 ♂, 3 ♀, YUGOSLAVIA: Serbia, Tuman, 17.v.1934 (CNC).

Baranov described this form from both sexes, but without stating the number of specimens. A single specimen was designated as 'Typus' in the original publication but without stated sex, and Baranov cited the type-locality as 'Dedinje-Bach bei Golubac'; we assume therefore that the holotype specimen was from the Dedinje stream, although this name does not appear on the holotype data label.

The CNC collection contains (from Baranov's collection) 5 ♂ and 3 ♀ specimens of *anderliceki* collected at Tuman (Serbia) on 17.v.1934. This locality was cited in the original descriptions, though without date, and these specimens are considered to be paratypes.

O. ornata f. *anderliceki* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 500) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen), form ***babici*** Baranov, 1937*a* : 261 (Croatian), 273 (German). Holotype ♂, YUGOSLAVIA: Macedonia, Skopje, Vardar, 21.i.1927 (CNC).

Paratypes: 1 ♂, 1 ♀, same data as holotype, except ♂ without 'Vardar' cited (CNC). 1 ♀, same data as holotype, except date 30.x.1926 (CNC). 1 ♂, same date as holotype, except date 18.i.1927 (CNC); 2 ♀, same data as holotype, except date 18.xi.1926 (CNC and BMNH). 6 ♂, 2 ♀, same data as holotype, except various dates 1–23.ii.1927 (all in CNC except one ♂ with date 23.ii.1927 in BMNH). 2 ♀, same data as holotype, except date 26.v.1927 (CNC). 1 ♀, same data as holotype, except additional locality Glumovo near Skopje and date 12.iv.1927 (CNC).

Baranov described this form from both sexes, but without stating the number of specimens. A single specimen, without stated sex, was designated as 'Typus' in the original publication and the date given as '21.1.1927', no other date being mentioned. We accept all of the above-listed paratypes as having this status as they all come from the type-locality or nearby, but most of them bear dates not cited by Baranov in the description. Baranov cited the exact type-locality as 'Vardar von Skoplje bis zur Mündung der Treska', but this full data does not appear on any of the type-specimens.

O. ornata f. *babici* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 501) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen), subsp. ***barensis*** Baranov, 1939*d* : 600 (Croatian), 601 (German). Syntypes ♀, YUGOSLAVIA: Montenegro, rivulet near Bar (formerly Antivari), viii.1938 (not located, presumed lost).

This subspecies was described from females (number of specimens not stated) reared from pupae, but the pupal stage was not itself described. No material of the taxon has been found, and the types are presumed lost.

The name *barensis* was overlooked by Smart (1945) and omitted from his catalogue of world Simuliidae. It is not placed by Rubzov (1959–1964) and remains enigmatic, though it may safely be presumed that it correctly applies to some species (probably *ornata*) of the genus-group segregate *Odagmia* Enderlein).

Odagmia ornata (Meigen), form ***bartulici*** Baranov, 1937*a* : 262 (Croatian), 274 (German). Holotype ♂, YUGOSLAVIA: Serbia, Donji Milanovac, 6.v.1936 (CNC).

Paratypes: 1 ♂, 4 ♀, same data as holotype (♂, 3 ♀ in CNC; 1 ♀ in BMNH). 1 ♀, YUGOSLAVIA: Serbia, Golubac, 1.vi.1924 (CNC); 1 ♀, same locality, date 20.v.1925 (CNC); 1 ♂, 2 ♀, same locality, date 30.vi.1925 (CNC). 2 ♂, without data (with Baranov's name labels, paratype status presumed).

Baranov described this form from both sexes, but without stating the number of specimens. A single specimen, without stated sex, was designated as 'Typus' in the original publication and the date given as '6.v.1936'; the type-locality was given as 'D. Milanovac (der Bach über welchen der Weg von D. Milanovac nach Greben fürht)'. Baranov also mentioned the locality 'Golubac' but without giving dates for the specimens from this locality (which have paratype status).

O. ornata f. *bartulici* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 501) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen), form ***borcici*** Baranov, 1937*a* : 261 (Croatian), 273 (German). Holotype ♀ [wings missing], YUGOSLAVIA: Macedonia, Skopje, 17.x.1926 [publ. as 1.xi.1926] (CNC).

Paratypes: 5 ♀, same data as holotype, except date 1.xi.1926 (CNC). 1 ♂, same data as holotype, except date 3.vii.1926 (CNC). 1 ♀, same data as holotype, except date 5.viii.1926 (CNC). 1 ♂, same data as holotype, except date 11.ix.1926 (CNC). 1 ♂, same data as holotype, except date 26.x.1926 (CNC). 1 ♂, 1 ♀, same data as holotype, except date 27.x.1926 (CNC). 1 ♀, same data as holotype, except date 30.x.1926 (CNC). 1 ♂, 1 ♀, same data as holotype, except date 4.xi.1926 (BMNH). 2 ♀, same data as holotype, except date 4.xi.1926 (CNC). 1 ♀, same data as holotype, except date 20.xi.1926 (CNC). 1 ♂, same data as holotype, except date 20.ii.1927 (CNC). 1 ♀, same data as holotype, except date 11.iv.1927 (CNC). 1 pupal exuvium, same data as holotype, except date 3.viii.1926 (CNC). 2 ♀, YUGOSLAVIA: Macedonia, Hanrijevo, 27.vi.1926 (CNC). 1 ♀, YUGOSLAVIA: Macedonia, Gradovzi, 1.x.1926 (CNC).

Baranov described this form from both sexes, but without stating the number of specimens. A single specimen, without stated sex, was designated as 'Typus' in the original publication and the date for this holotype was cited as '1.xi.1926'. A discrepancy exists in Baranov's collection concerning the holotype and its data: the collection contains five specimens on two mounts which have the date '1.xi.1926', but the single female specimen marked as 'Typus' by Baranov bears the date '17.x.1926'; it appears either that Baranov marked the wrong specimen as type or that he cited the wrong date in publication. The specimens having the date '1.xi.1926' exist as a pair on one mount and a trio on one mount, and it is unlikely that Baranov intended one of these specimens—not clearly separated from the others—to be 'Typus', and we consider it best to accept the specimen indicated as type by Baranov to be the holotype. We hold, therefore, that Baranov inadvertently cited the wrong date in publication for this specimen, and that the correct date for the holotype data is '17.x.1926'.

The form *borcici* is one of the 'Vardar-Formenkomplex', i.e. forms of *ornata* described from the geographical area of the Vardar river, Macedonia, and the specimens came from the Skopje and Hanrijevo environs according to Baranov's description. The specimens listed above, apart from the holotype, are all paratypes, but it should be noted that the CNC collection contains in addition two male and two female specimens under the name *borcici* from Baranov's collection that have the data 'Golubaz, 10.xi.[1]924'; as these specimens are from Golubac on the Danube in Serbia (outside the area of the 'Vardar-Formenkomplex') and this locality is nowhere mentioned in the original description, it is considered that they have no type-status.

O. ornata f. *borcici* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 502, 510) listed *borcici* with the erroneous spelling *borici*, and (p. 502) gave the publication date as 1936 in error.

Odagmia ornata (Meigen), form ***guelminoi*** Baranov, 1937*a* : 262 (Croatian), 273 (German). Holotype ♀, YUGOSLAVIA: Serbia, Niŝ, 1.vi.1935 (CNC).

Paratypes: 3 ♂, 2 ♀, same data as holotype (CNC, all badly damaged). 22 ♂, 32 ♀, YUGOSLAVIA: Serbia, Pukovac, 1935 (CNC, except 2 ♂, 2 ♀ in BMNH). 6 ♀, YUGOSLAVIA: Serbia, Tuman, vi.1925 (CNC).

Baranov described this form from both sexes, but without stating the number of specimens. The single specimen listed above as holotype was designated as 'Typus' but without stated sex.

O. ornata f. *guelminoi* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 505) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen) form ***nikolici*** Baranov, 1937*a* : 262 (Croatian), 274 (German). Holotype ♀, YUGOSLAVIA: Serbia, Niŝ, A [sic].iv.1935 (CNC).

Paratypes: 3 ♂, 1 ♀, same data as holotype (2 ♂, ♀ in CNC; 1 ♂ in BMNH). 4 ♂, 1 ♀, YUGOSLAVIA: Serbia, Kurŝumlija, 10.iv.1935 (CNC).

Baranov described this form from both sexes, but without stating the number of specimens. The single specimen cited above as holotype was designated as 'Typus' but without stated sex. The three Serbian localities Niŝ, Pirot, and Kurŝumlija, were cited in the description, but we have found no paratype specimens from the Pirot locality.

O. ornata f. *nikolici* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 509) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen), form ***prima*** Baranov, 1926*b* : 184, 189. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, Tuman, 5.iv.1925 (CNC).

Paralectotypes: 1 ♂, same data as lectotype (and on same mount) (CNC). 3 ♀, YUGOSLAVIA: Serbia, Golubac, 25.iv.1925 (CNC); 1 ♂, 2 ♀, same locality, date 26.iv.1925 (CNC); 1 ♂, 1 ♀, same locality, date 24.v.1925 (CNC).

This form was described from both sexes, pupae and larvae, but we have seen no immature stage syntypes and presume that these were lost with the rest of Baranov's alcohol material. No localities were cited in the original description, Baranov merely stating that the form was present everywhere ('Überall vorhanden'); all the above-listed specimens can be accepted as original syntypes. In addition the CNC collection contains, from Baranov's collection, another female specimen from the type-locality (Tuman) but with the collection date '26.iv. 1927'; as this specimen was collected in the year after form *prima* was described it is not an original syntype.

O. ornata f. *prima* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

The name is a primary homonym of *prima* Baranov (form of *Odagmia ruficornis*), and a secondary homonym in *Simulium* s.l. of *prima* Baranov (1926*b*, forms of *equina* L., *aurea* Fries, and *stylata* Baranov).

Odagmia ornata (Meigen), form ***savici*** Baranov, 1937*a* : 262 (Croatian), 274 (German). Holotype ♂, YUGOSLAVIA: Serbia, Pirot, 12.iv.1935 (CNC).

Paratypes: 5 ♂, 2 ♀, same data as holotype (4 ♂, 1 ♀ in CNC; 1 ♂, 1 ♀ in BMNH).

Baranov does not specifically mention characters of the male in the original descriptions, but as males with the correct cited date (of which one is labelled by Baranov as 'Typus') and from the single cited locality stand with the females in his collection, and as it is known that all the other forms of *ornata* described in the 1937*a* work were based on both sexes, we consider it certain that the males were before Baranov at the time of description and that they should be considered to be original syntypes.

O. ornata f. *savici* is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 513) gives the publication date of this name as 1936 in error.

Odagmia ornata (Meigen), form ***secunda*** Baranov, 1926*b* : 184, 191. Syntypes ♂, ♀, pupae, larvae, YUGOSLAVIA: Serbia, Tuman; & Macedonia, Skopje (not located and presumed lost).

Baranov described both sexes of this form, and also presumably had the immature stages before him at the time of description (as he stated 'Puppe und Larve sind der *O. ornata*

prima ähnlich'). No adult syntypes are present in Baranov's collection in CNC, and his alcohol material of immature stages was doubtless lost with the rest of his alcohol collection at the end of the war in Vienna. So far as we can tell, therefore, all type-material is lost.

However, it should be noted that Baranov's collection in CNC contains one female specimen from Skopje (one of the syntypic localities recorded by Baranov), but this specimen has the collection date '1.xi.1926'; the paper containing the original description of *secunda* was published in March, 1926, and this specimen cannot therefore be an original syntype (it is labelled as 'neotypus' by Baranov but was never published as such). The CNC collection also contains, from Baranov's collection, labelled in error as cotypes, one female and two male specimens named as *ornata* form *secunda* and having the data 'Golubac, 26.iv.1927'; these specimens also are not original syntypes as they come from a locality not mentioned in the original description (Baranov stated that he had specimens only from Tuman and Skopje) and were collected more than a year after the original description had been published.

O. ornata f. *secunda* is not placed by Rubzov (1959–1964); in the absence of type-material we cannot absolutely confirm that assignment to *Odagmia* is correct, but this may be presumed from the fact that *ornata* is type-species of *Odagmia* and Baranov's form *secunda* is really certain to belong to this genus-group concept.

The name is a primary homonym of *secunda* Baranov (form of *Odagmia ruficornis*), and a secondary homonym in *Simulium* s.l. of *secunda* Baranov (1926*b*, forms of *equina* L., *aurea* Fries, and *stylata* Baranov).

Odagmia ornata (Meigen), form ***zagrebiensis*** Baranov, 1937*a* : 263 (Croatian), 274 (German). LECTOTYPE ♂, by present designation, YUGOSLAVIA: Croatia, Zagreb, 10.ii.1931 (CNC).

Paralectotypes: 1 ♂, same data as lectotype, except date 16.i.1931 (CNC). 1 ♂, same data as lectotype, except date 27.i.1931 (CNC). 1 ♂, same data as lectotype, except date 12.ii.1931 (BMNH). 1 ♀, same data as lectotype, except date 17.ii.1931 (CNC).

Baranov described this form from an unstated number of specimens of both sexes and did not designate a 'Typus'; present designation of a lectotype is therefore necessary. In the original publication Baranov gave the date range '10–17.ii.1931' and this agrees with data labels on most of the specimens in his collection; however there are two specimens with slightly different dates (viz. 16.i. and 27.i.1931) from that cited, but we nevertheless regard these as original syntypes (they were regarded as types by Baranov and all evidence suggests that they were available to him at the time of description).

O. ornata f. *zagrebiensis* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 516) gives the publication date of this name as 1936 in error.

Odagmia ruficornis Baranov, 1926*b* : 184, and ***O. ruficornis*** Baranov, form ***prima*** Baranov, 1926*b* : 184, 191. LECTOTYPE ♂, by present designation, YUGOSLAVIA: Serbia, Golubac, 27.v.1925 (CNC).

Paralectotypes: 2 ♂, same data as lectotype (CNC).

Baranov's (1926*b*) description of *Odagmia ruficornis* and its two forms (*prima* and *secunda*) is very confused, and some discussion is here necessary. The availability of these names rests upon the entry in the key on p. 184 of the original publication and on the descriptive matter on p. 191. The key entry reads:

'26 (29) Fühler des ♀ ganz hellrot . . . *ruficornis* n.sp.
27 (28) H.-Schenkel hell mit schwarzem Ende . . . *ruficornis prima* n.f.
28 (27) H.-Schenkel ganz hell . . . *ruficornis secunda* n.f.'

and the 'descriptive' entry reads:

> '14–15. *Odagmia ruficornis prima* und *secunda* nn.ff. ♀♀. Ausser durch die roten Fühler unterscheiden sie sich von *O. ornata* durch eine hellere Körperfarbe und gleichmässige, gröbere und dichtere, mehr silberige Behaarung.
>
> Ich habe beide Formen aus Tuman und Golubaz.'

The numbers 14 and 15 preceding the descriptive matter are serial numbers in a list of Simuliid species (the preceding number 13 referring to *Odagmia ornata nitidifrons* Edwards and the succeeding number 16 referring to *Odagmia kondici* Baranov). It is evident therefore that Baranov was proposing two separate taxa only (No. 14 and No. 15), differing in detail of leg colouring but together forming the new species *ruficornis* distinguished by its red antennae. From this it is plain that form *prima* was intended to be the typical or nominate form, and therefore that the species *ruficornis* is based upon the same type-material as form *prima*. Baranov's collection in CNC contains no specimens labelled as *prima* but does contain specimens labelled simply as *ruficornis*, and these specimens if accepted as syntypes are automatically types of both *ruficornis* and of *ruficornis* f. *prima*.

Unfortunately the status of the existing specimens in Baranov's collection is not absolutely certain, because all of them are males and Baranov's very deficient descriptive matter and key appear to mention only the female. It is well known, however, that Baranov must have had on many occasions specimens in front of him that he failed to note in publication, and that many types of discrepancy exist between cited information in his publications and the sex and data of specimens. In the case of *ruficornis* and *ruficornis* f. *prima* we here take the view that the three ♂ specimens in Baranov's collection and labelled by him as types are acceptable as being original syntypes, and we have designated a lectotype from them accordingly.

The name *ruficornis* Baranov is a junior secondary homonym in *Simulium* s.l. of *Simulium ruficorne* Macquart, 1838, and Smart (1944 : 133) published the replacement name *baracorne* Smart for the preoccupied *ruficornis* Baranov. Rubzov (1963 : 472–474) places *ruficornis* Baranov, under the name *Odagmia baracornis* (Smart), as a valid species of the *ornata*-group of *Odagmia*; we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Odagmia ruficornis Baranov, form ***secunda*** Baranov, 1926*b* : 184. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, Golubac, 27.v.1925 (CNC).

Paralectotype: 1 ♀, YUGOSLAVIA: Serbia, Negotin, ix.1924 (CNC).

Baranov (1926*b* : 191) only mentioned the localities Tuman and Golubac with reference to *ruficornis* forms *prima* and *secunda* but we think it reasonable to accept the specimen from Negotin (listed above as paralectotype) as an original syntype; Negotin lies in the same general area of north-east Serbia as the cited localities, and the specimen has Baranov's label as a type; we infer that the specimen was available to Baranov at the time of description.

O. ruficornis f. *secunda* is cited by Rubzov (1963 : 473) in the section headed 'Variabilität' under the name *Odagmia baracornis baracornis* Smart, and he evidently does not recognize separate status from the nominal taxon, *prima* (=*ruficornis* Baranov s.str., =*baracornis* Smart). We confirm from lectotype examination that *secunda* is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

The name is a primary homonym of *secunda* Baranov (form of *Odagmia ornata*), and a secondary homonym in *Simulium* s.l. of *secunda* Baranov (1926*b*, forms of *equina* L., *aurea* Fries, and *stylata* Baranov).

Odagmia tenuitarsus Baranov, 1937*a* : 264 (Croatian), 276 (German). Holotype ♀, YUGOSLAVIA: Croatia, Zagreb, 9.iv.1929 (CNC).

This species is not placed by Rubzov (1959–1964). We confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

The name is a junior secondary homonym in *Simulium* s.l. of *Simulium tenuitarsus* Puri, 1933, and Smart (1945 : 528) has published the replacement name *baranovi* Smart for the preoccupied *tenuitarsus* Baranov.

Smart (1945 : 514) gives the publication date of *tenuitarsus* Baranov as 1936 in error.

Simulium agnatum Baranov, 1937*a* : 259 (Croatian), 272 (German). Holotype ♀, YUGOSLAVIA: Serbia (CNC).

Paratype: 1 ♀, YUGOSLAVIA: Bosnia, Sarajevo, 1932 (CNC).

Baranov described this species only from the two female specimens cited above, which he designated as 'Holotypus' and 'Paratypus' respectively.

This species is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Smart (1945 : 500) gives the publication date of this name as 1936 in error.

Simulium begbunaricum Baranov, 1924 : 65. Syntypes ♂ [? also ♀], YUGOSLAVIA: Serbia, Golubac & Kučevo & Zaječar (lost).

The type-material of this species was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). Although the type-material is lost the identity of *begbunaricum* is known from the footnote in Baranov's (1926*b* : 183) paper in which he stated that 'Die Art *S. begbunaricum* Bar. 1924 war eine Mischart und zerfiel in *equina*-Formen', a statement that we take clearly to imply that *begbunaricum* is a synonym of *Simulium equinum* (Linnaeus); this in turn confirms that the name applies to a species of the genus-group segregate *Wilhelmia* Enderlein, to which *equinum* belongs. The name is not given by Rubzov (1959–1964).

The original description of *begbunaricum* was published in Serbian by Baranov (1924) in the Yugoslav journal *Glasnik Ministarstva Poljoprivrede i Voda* (Vol. **2**, No. 7, p. 65), but in the following year Baranov (1925) again described the species as new, citing it as 'n.sp.' in both a key in Serbian (pp. 6 & 7 of the 1925 paper) and in a German description (p. 10 of the 1925 paper). Smart (1945 : 501) overlooked the 1924 paper and cited the German description on p. 10 of the 1925 paper as the original description in error; Smart (loc. cit.) also inadvertently mis-spelt the name as *begbungaricum*. (This curious specific name alludes to the cliff-cave of 'Beg-Bunar' on the Danube, from which according to local superstition the infamous Golubatz-fly is supposed to emerge, and *begbunaricum* is the correct spelling.)

Simulium brnizense Baranov, 1924 : 66. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, near Golubac, Brniza [on label 'Brnjica'], 1924 (CNC).

Paralectotypes: none located, presumed lost.

The original Serbian description of this species appears to be based mainly on the male and includes a figure of the ♂ hypopygium, but Baranov makes it clear (especially in the second, German, description in 1925 mentioned below) that he had several specimens reared from pupae and these doubtless included females. We think it justified, therefore, to consider the one existing specimen in Baranov's collection in CNC that has the appropriate data (Brniza, 1924) and bears Baranov's label as 'Typus' as being an original syntype; we here designate it as lectotype. No male syntypes exist in Baranov's collection and these must be presumed lost.

The CNC collection contains specimens from Baranov's collection standing under the name *brnizense* together with the lectotype, but these additional specimens have no type-status, even though labelled as cotypes by Baranov (as none are from the type-locality and all were collected after the date of publication): they comprise four males and two females from Macedonia with the following data: 1 ♂, Treska, 9.xi.1926; 2 ♂, Vardar, 10.xi.1926; 1 ♀, Skopje, 11.xi.1926; 1 ♂, Skopje, 17.xi.1926; 1 ♀, Kabajep [spelling partly illegible, uncertain], 20.v.1927.

The original description of *brnizense* was published in Serbian by Baranov (1924) in the Yugoslav journal *Glasnik Ministarstva Poljoprivrede i Voda* (Vol. **2**, pt. 7, p. 66), but in the following year Baranov (1925) again described the species as new, citing it as 'n.sp.' in both a key in Serbian (pp. 6 & 7 of the 1925 paper) and in a German description (p. 10 of the 1925 paper). Smart (1945 : 502) made a very confused entry for the species in his world catalogue of Simuliidae, giving two different spellings and two different references for the same species: his first reference to '*brizensis* [sic] Baranov (1924 : 66)' is in error for the spelling of the name but is correct for the bibliographic reference, but his second reference to '*bruigense* Baranov (1925 : 10)' is wrong for both spelling of the name and the reference. The reference

given by Smart (loc. cit.) against the mis-spelling *bruigense* refers to Baranov's German description of *brnizense* in the later (1925) paper and not to the first (original) Serbian description.

We confirm from lectotype examination that *brnizense* is correctly assignable to the genus-group segregate *Wilhelmia* Enderlein, where Baranov (1926*b* : 187, and subsequent publications) himself placed it. Rubzov (1962 : 401), following earlier authors and using the mis-spelling *brizensis*, places the name as a synonym of *falcula* Enderlein (a supposed subspecies of *equina* (L.)). There are several references in the literature to Baranov's name with the spelling *brizensis*, but the name alludes to Brniza near Golubac in Serbia and Baranov's original spelling is correct.

Simulium columbaczense (Schoenbauer), race ***litorale*** Baranov, 1937*b* : 159, 164. LECTOTYPE ♂, by present designation, YUGOSLAVIA: Serbia, Golubac, 26.v.1936 (CNC).

Paralectotypes: 2 ♀, same data as lectotype, except date 22.v.1928 (CNC). 1 ♂, 20 ♀, same data as lectotype, except date 25.v.1928 (CNC). 9 ♂, 62 ♀, same data as lectotype (7 ♂, 60 ♀, in CNC; 2 ♂, 2 ♀ in BMNH).

Baranov did not publish a formal description of this race, but the name is nomenclatorially available from its first publication by Baranov (1937*b*) because characteristics are cited of the adult which differentiate *litorale*; all adult specimens cited above are acceptable as original syntypes and a lectotype is designated from them. Race *litorale* was named for those *Simulium columbaczense* (Schoenbauer) that breed in shallow waters of the Danube near Golubac, and in a later paper Baranov (1939*a* : 122) was very precise about the exact type-locality, stating that 'die typische Lokalität dieser Rasse [i.e. *litorale*] ist die Insel in der Nähe der Dampferanlegestelle bei Golubac'; this full detail is not however indicated on the type-material. Baranov referred to *litorale* as an ecological race ('ökologische Rasse') morphologically distinct from another ecological race (*profundale*) with which it was allopatric, since the *profundale* race occurred in the depths of the Danube at Donji Milanovac; as Baranov did not recognize subspecies of *columbaczense*, and as he referred *litorale* and *profundale* to be characteristic of particular geographical areas, the names of these ecological races are not interpreted as infrasubspecific in the terms of Article 45 (d) of the *International Code of Zoological Nomenclature*, 1961; they are therefore available species-group names with status under the *Code*.

No authors except Baranov have seen the need to recognize named 'races' of the Golubatz fly, and we concur in this view. The name *litorale* is a synonym of *Simulium colombaschense* (Fabricius) (syn. *S. columbaczense* (Schoenbauer)), the type-species of *Simulium* Latreille, without separate species-group status. Rubzov (1959–1964) omits the name *litorale*.

Simulium columbaczense (Schoenbauer), race ***profundale*** Baranov, 1937*b* : 159, 164. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, Donji Milanovac, 9.v.1936 (CNC).

Paralectotypes: 23 ♂, 26 ♀, same data as lectotype (21 ♂, 24 ♀ in CNC; 2 ♂, 2 ♀ in BMNH).

Baranov did not publish a formal description of this race, but the name is nomenclatorially available from its first publication by Baranov (1937*b*) because characteristics are cited of the adult which differentiate *profundale*; all adult specimens cited above are acceptable as original syntypes and a lectotype is designated from them. Race *profundale* was named for those *Simulium columbaczense* (Schoenbauer) that breed in the depths of the Danube near Donji Milanovac, and in a later paper Baranov (1939*a* : 122) was very precise about the exact type-locality, stating that 'die typische Lokalität ist bei Donji Milanovac, hinter den Traversen der Flussregulierung in einer Tiefe von 4–6 m, doch gibt es auch Fundorte von einer Tiefe die 20 m überschreitet'; this full data does not of course appear on the data on the adult syntypes, which are simply labelled as from D. Milanovac.

Baranov referred to *profundale* as an ecological race ('ökologische Rasse') morphologically distinct from another ecological race (*litorale*) with which it was allopatric, since the *litorale*

race occurred in the Danube in shallow waters near Golubac; the name *profundale* has status in nomenclature for the reasons outlined under *litorale* (see above).

No authors except Baranov have seen the need to recognize named races of the Golubatz fly, and we concur in this view. The name *profundale* is a synonym of *Simulium colombaschense* (Fabricius) (syn. *S. columbaczense* (Schoenbauer)), the type-species of *Simulium* Latreille, without separate species-group status. Rubzov (1959–1964) omits the name *profundale*.

Simulium djerdapense Baranov, 1937*a* : 258 (Croatian), 270 (German). Holotype ♀, YUGOSLAVIA: Serbia, Golubac, 28.iv.1936 (CNC).

Baranov did not state the number of specimens in the original description, which was based solely on the female, and in the absence of any evidence to the contrary we accept the single ♀ specimen in Baranov's collection in CNC as holotype; its data agree with that cited in the original publication.

This species is not placed by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to the genus-group segregate *Odagmia* Enderlein.

Smart (1945 : 504) gives the publication date of this name as 1936 in error.

Simulium reptans (Linnaeus), form ***calopum*** Baranov, 1926*b* : 184, 189. LECTOTYPE ♀, by present designation, YUGOSLAVIA: Serbia, [River] Timok, ix.1924 (CNC).

Paralectotype: 1 ♀, same data as lectotype (CNC).

In the case of this nominal taxon there is serious discrepancy between the specimens that are labelled as types of *calopum* by Baranov in his collection in CNC and the information published in the original description, and it is necessary to annotate this in some detail. The entire description of *Simulium reptans calopum* n.f. (in Baranov, 1926*b* : 189) reads as follows:

'Diese Form unterscheidet sich von beiden vorhergehenden in beiden Geschlechtern durch die helleren Beine. Hypopygium des Männchens (Fig. 5) mit für reptans charakteristischem Griffel und starker Bürste. Ich habe sie aus dem Timok und dem Vardar und aus einem grösseren Bach neben Svilajnaz (Serbien).'

From this description two things are certain, firstly that the description was based on both sexes and secondly that the original (type) material was from the rivers Timok (in Serbia) and Vardar (in Macedonia), and from a stream at Svilajnaz (= Svilajnac) in Serbia. In all, Baranov's collection in CNC contains five ♂, seven ♀ and three pupal (exuviae) specimens, each bearing Baranov's cotype label, standing under *calopum*, but of these only two females are true original syntypes: these two specimens are from the river Timok, one of the cited type-localities, and have the collection date 'IX.1924', early enough to pre-date the original description.

The remaining specimens of *calopum* in the Baranov collection have no type-status, either because they are not from an original type-locality or because the collecting dates post-date the time of description (or because both date and locality conflict). Apart from the two Timok syntypes (here designated as lectotype and paralectotype) the data of the other specimens that lack type-status are as follows: Serbia, Golubac; 1 ♂, 1 ♀, date a. [sic] vi.1924; 1 ♂, date 22.iv.1925; 1 ♀, date 13.v.1925; 1 ♀, date 25.iv.1927. Serbia, Brniza; 1 ♂, date 30.iv.1927. Serbia, Tuman; 1 ♂, 1 ♀, date 26.iv.1927. Macedonia, Skopje; 1 ♀, date 11.iv.1927 (labelled as type by Baranov); 1 ♂, date 11.ix.1927; 3 pupal exuviae, date 9.iv.1927. The last-named locality, Skopje, is on the river Vardar (one of the type-localities cited by Baranov) and on the basis of locality alone the specimens from Skopje appear at first to be syntypes, but as the original description was published in 1926 (March) and the specimens were not collected until 1927 they cannot be original material; likewise the specimens from Golubac, Brniza and Tuman are not original syntypes as they are not from the type-localities and most of them also were collected after the time of description.

S. reptans f. *calopum* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Simulium reptans (Linnaeus), subsp. ***glumovoense*** Baranov, 1937*a* : 257 (Croatian), 270 (German). LECTOTYPE ♀, by present designation, YUGOSLAVIA: Macedonia, Skopje, Glumovo, 12.iv.1927 (CNC).

Paralectotypes: 2 ♀, same data as lectotype (CNC). 1 ♀ ex pupa (cocoon only remaining), YUGOSLAVIA: Macedonia, [River] Treska, Glumovo, 6.iv.1927 (pupa), 10.iv.1927 (emerged adult) (CNC).

This subspecies was described only from the female. The number of specimens was not clearly indicated, but Baranov cited the dates 6.iv. and 10.iv.1927 near the beginning of the Croatian description (p. 257) and 12.iv.1927 at the end, implying more than one specimen (although in the abbreviated German description on p. 270 he mentioned only the date 12.iv.1927). There are four specimens in Baranov's collection in CNC conforming to the sex and various cited dates and these are clearly all original syntypes and are listed above; in addition there is one male specimen from the type-locality (Skopje, Glumovo) but as the male was not described and the specimen has a conflicting date (13.iv.1927) it is not accepted as having any type-status.

This subspecies is not mentioned by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Smart (1945 : 505) gives the publication date of this name as 1936 in error.

Simulium reptans (Linnaeus), form ***ornatoide*** Baranov, 1926*b* : 184, 189. Holotype or syntypes ♂, YUGOSLAVIA: Serbia, Tuman, 12.vi.1925 (lost).

The type-material of this species was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell).

S. reptans f. *ornatoide* is not placed by Rubzov (1959–1964). In the absence of type-material the name is enigmatic, but presumably applied without doubt to a species of *Simulium* s.str., in which genus-group segregate *S. reptans* (Linnaeus) belongs.

Simulium reptans (Linnaeus), subsp. ***pseudocolumbaczense*** Baranov, 1937*a* : 255 (Croatian), 269 (German). Holotype ♀, YUGOSLAVIA: Serbia, Golubac, Donau [=R. Danube], 1.v.1936 (CNC).

This subspecies was described from a single specimen (the above-listed holotype) reared from the pupa. Baranov makes it clear that he had only one specimen from statements in both Croatian and German descriptions.

This subspecies is not mentioned by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Smart (1945 : 512) gives the publication date of this name as 1936 in error.

Simulium reptans (Linnaeus), subsp. ***pukovacense*** Baranov, 1937*a* : 256 (Croatian), 269 (German). LECTOTYPE ♀, by present designation, YUGOSLAVIA: Macedonia, Pukovac, 23.v.1935 (CNC).

Paralectotypes: 1 ♂, 5 ♀, same data as lectotype (♂, 4 ♀ in CNC; 1 ♀ in BMNH).

This subspecies is not mentioned by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to *Simulium* s.str.

Smart (1945 : 512) gives the publication date of this name as 1936 in error.

Simulium reptans (Linnaeus), subsp. ***tumanicum*** Baranov, 1937*a* : 255 (Croatian), 269 (German). Holotype ♀, YUGOSLAVIA: Serbia, Tuman, 16.iv.1926 (CNC).

In the original description Baranov cited one female specimen from Tuman (locality to which the name refers) with date 16.iv.1926, and the specimen with this data in the Baranov collection is certainly the holotype. However it should be noted that CNC collection contains three other specimens of *tumanicum* from Baranov's collection which have no type-status, viz. 2 ♂, Tuman, 9.iv.1926, and 1 ♀, Serbia, Golubac, 13.iv.1926; there is no evidence that Baranov had the male at the time of description, these dates were not cited, and no

specimens were mentioned from Golubac, and we conclude that the specimens lack type-status even though labelled as cotypes by Baranov.

This subspecies is not mentioned by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Smart (1945 : 515) gives the publication date of this name as 1936 in error.

Simulium reptans (Linnaeus), subsp. ***vardaricum*** Baranov, 1937*a* : 256 (Croatian), 270 (German). Holotype ♀, YUGOSLAVIA: Macedonia, Skopje, 11.vi.1926 (CNC).

Paratypes: 1 pupal exuvium, same data as holotype, except date 31.vii.1926 (CNC). 1 cocoon, same data as holotype, except date 9.iv.1927 (CNC).

In the original Croatian description Baranov briefly described the larva and pupa of this subspecies from the Vardar River near Skopje, and based the description of the adult female on one specimen reared from the pupa which emerged on 11.vi.1926 and was cited as type. As the pupa of this subspecies was described, as well as the female, we accept the pupal pelt and the empty cocoon standing with the holotype in Baranov's collection as paratypes (see above); they came from the type-locality, but Baranov did not mention dates for his pupal material in the description.

This subspecies is not mentioned by Rubzov (1959–1964); we confirm from holotype examination that it is correctly assignable to *Simulium* Latreille s.str.

Smart (1945 : 515) gives the publication date of this name as 1936 in error.

Simulium (Nevermannia) serbicum Baranov, 1925 : 6, 7 (Serbian), 9 (German). Syntypes ♂, ♀, pupae, YUGOSLAVIA: East Serbia, stream near Vrashegranaz, 21.ix.1924 (not located, probably all lost).

Baranov described this species from one female and three male specimens which had been reared from pupae. The pupae were stated to recall those of small *ornatum*, but to differ by having only four gill filaments. No type-specimen was designated, and the four reared adults plus pupae therefore had syntype status.

In the description of the male Baranov recorded 'Ich besitze nur Alkohol Material'; the alcohol material from Baranov's collection is known to be lost and there is no extant male or pupal syntype material. The one female syntype was not stated to be in alcohol and may have been a pinned specimen, but it, too, appears to be lost. It must be noted, however, that Baranov's list of specimens sold to the Department of Agriculture, Ottawa, in 1954 mentioned ones specimen of *serbicum*, and that this specimen was marked off as present in the collection when it was received at Ottawa; the sex was not recorded. Whether this specimen was the single female syntype cannot be ascertained, as the specimen cannot now be found in the Baranov collection in Ottawa; it appears to have been lost, assuming it was in fact received in Ottawa, as records show that no specimen of *serbicum* was sent out on loan from the collection (failure to return a loan specimen therefore does not account for absence of the *serbicum* specimen from Baranov's collection).

Sherban (1961 : 677) reported that he had studied Baranov's 'holotype' of *serbicum* and found that it did not belong to the same species as *serbicum* Baranov in the sense of Rubzov. We are puzzled by this statement, as we do not think it possible that the specimen to which Sherban referred can possibly be an original type-specimen: most of the original material was in alcohol and is known to be lost, there are no Baranov simuliid types existing in Yugoslavia or elsewhere in south-east Europe so far as we know, and Sherban did not see the one specimen of *serbicum* in Ottawa from Baranov's collection (see above paragraph). We have not been able to obtain information from Dr Sherban but we tentatively conclude that the specimen he saw was not one of Baranov's original *serbicum* specimens. It appears instead to have been a specimen from the river Medoviza in Yugoslavia which Rubzov in error considered to be a *serbicum* type, because Rubzov (1962 : 380) in his account of *serbicum* makes the statement 'Typus aus dem Fluss Medoviza (Jugoslawien)'; Rubzov's statement of the type-locality is completely at variance with anything indicated by Baranov, and his 'Typus' cannot in reality, whatever the specimen may be, have any type-status. Sherban mentions

the Medoviza locality and Rubzov's specimen and appears to have confused this with Baranov's 'type'. That Sherban was following Rubzov's interpretation of the 'type' of *serbicum* seems evident from the fact that he repeated Rubzov's (1956 : 521) error of giving *Pseudonevermannia* as the original genus: *serbicum* was actually described by Baranov in *Simulium* (*Nevermannia*), and the description in fact predated the erection of the segregate *Pseudonevermannia* Baranov, 1926.

Shortly after the description Baranov (1926*b*, 1927*a* and 1929) placed *serbicum* in *Nevermannia*, regarding the latter as a genus, and aggregated it with *aureum* Fries. *Nevermannia* is now regarded as a synonym of *Eusimulium*, to which segregate *serbicum* (though the type-material is lost) undoubtedly belongs: Baranov's (1925) figure of the male hypopygium and his figure of the branching of the 4-filamented pupal gill (Baranov, 1927*a*) confirm that the species belongs in the *aureum*-group of *Eusimulium*, where Rubzov (1956 : 521; 1962 : 380) places it.

Smart (1945 : 513) cited *Nevermannia* as the original genus for *serbicum*, whereas the original combination was *Simulium* (*Nevermannia*) *serbicum*. Smart (*op. cit.*), following Enderlein, gave *serbicum* as a synonym of *kerteszi* Enderlein, but this synonymy is not upheld by Rubzov and is almost certainly wrong (the two nominal species correctly belonging in different species-groups).

Živkovič (1966 : 263), in her account of the *aureum*-group in Yugoslavia, mentions that Sherban considered *serbicum* in the sense of Rubzov to be a misidentification of the true *serbicum* Baranov, and uses the name *Simulium rubzovianum* Sherban (which Sherban, 1961, proposed for *serbicum* of Rubzov, not Baranov) for a valid species of the group; she does not, however, provide any information on the identity of the true *serbicum* Baranov (though almost certainly this name must apply to, and have priority for, one of the Yugoslav species of the *aureum*-group to which she refers).

Wilhelmia equina (Linnaeus), form ***prima*** Baranov, 1926*b* : 184, 185. LECTOTYPE ♂, by present designation, YUGOSLAVIA: Serbia, Tuman, lower Danube ('untere Donau'), 23.vi.1924 (CNC, with pupal exuvium).

Paralectotypes: 1 ♀, YUGOSLAVIA: Serbia ('Ost-Serbia'), Tuman, 12.vi.1925 (CNC). 3 ♂, 4 ♀, YUGOSLAVIA: Serbia, Tuman, 9.vi.1925 (CNC).

There is some confusion in Baranov's collection concerning the true type-material of this nominal taxon, for the collection contains specimens that cannot be types although labelled as such by Baranov and at the same time contains specimens that we believe to be types though not labelled as such. Detailed annotation is therefore necessary.

Form *prima* of *equina* is a nominal species-group taxon of which the syntypes are the original male, female, pupal and larval specimens very briefly described by Baranov from specimens obtained at Tuman and Treska; the only information in the original description concerning locality and date is contained in Baranov's statement 'Ich sammelte sie massenhaft im Juni in Tuman (Serbien) und im August–September in Treska (Mazedonien)'. In practice Baranov used the name *prima* for what would now be referred to as the typical or nominate form, so that his *equina prima* is synonymous with the entity we would now call *equina equina*. His collection in CNC contains specimens standing under the name *Wilhelmia equina* and others named as *equina* form *prima*, but we believe that some of the true original syntypes of *prima* are contained among the specimens named simply as *equina* (not surprising in view of the fact that Baranov's typical *equina* concept was the same as *prima*), and that his specimens named as types of *prima* can have no such status.

The specimens named and labelled as types of *prima* were all collected *after* the date of publication of the name (March, 1926), and therefore cannot be original syntypes in spite of Baranov's labels; furthermore they were all collected at Skopje, which is not one of the cited original localities. In all they are comprised as follows: 1 ♂, 1 ♀, Skopje, Vardar River, 7.xi.1926; 1 ♀, Skopje, 8.ix.1926; 1 ♀, Skopje, 4.xi.1926. We consider all of these specimens to be later collected material erroneously labelled as types.

Among the material named simply as *equina*, however, we have found nine specimens from Tuman (one of the originally cited type-localities) that bear collecting dates June, 1924, and June, 1925, and we believe that these specimens (which must have been available to Baranov at the time of description of *prima*) represent part of the original *prima* type-material; their data fits with Baranov's statement 'im Juni in Tuman' and they were collected well before the publication date of the name. Accordingly we accept these nine specimens as original syntypes and designate a lectotype from them (see above, where full data of the lectotype and remaining syntypes, i.e. paralectotypes, are indicated).

The *equina* material in Baranov's collection contains nine female specimens from Treska (the other type-locality that Baranov cited), but as all have data post-dating publication none of them are syntypes of *prima*. We have not located any adult syntypes from this locality, and these we believe lost; Baranov's larval and pupal material is also presumed lost except for the pupal exuvium of the lectotype and of two of the paralectotypes.

W. equina f. *prima* is not mentioned by Rubzov (1959–1964). The name was clearly used by Baranov for the typical or nominate *equina* and is therefore to be treated as a synonym of *equina* Linnaeus, a species-group taxon of the genus-group segregate *Wilhelmia* Enderlein. This is here confirmed from examination of the lectotype. The name is a primary homonym of *prima* Baranov (form of *Wilhelmia stylata*), and a secondary homonym in *Simulium* s.l. of *prima* Baranov (1926*b*, forms of *aurea* Fries, *ornata* Meigen and *ruficornis* Baranov).

Wilhelmia equina (Linnaeus), form ***quarta*** Baranov, 1926*b* : 184. LECTOTYPE ♂, by present designation, YUGOSLAVIA: Serbia, Golubac, e [sic] vi.1924 (CNC).

Paralectotype: 1 ♂, same data as lectotype (but label with capital 'E') (CNC).

Smart (1945 : 512) cites p. 186 in Baranov (1926*b*) for the original description of this form but differentiating features of *quarta* are not clearly stated on this page, and the availability of the name rests upon Baranov's entry in the key on p. 184, where the form is differentiated by its pale legs. Baranov did not indicate the sex and presumably his statement of 'Beine hell' is meant to apply to both sexes; he certainly also had larvae and pupae at the time of description as the immature stages of forms *quarta*, *secunda* and *tertia* are referred to on p. 186.

The only existing specimens that can be considered original syntypes are the two males recorded above as lectotype and paralectotype. Baranov did not cite any localities for *quarta* but on p. 184, before the key, he mentions that the paper as a whole is based on specimens from north-east Serbia and from the surroundings of Skopje; the specimens from Golubac (north-eastern Serbia) were collected in June, 1924, and can therefore be considered original syntypes because of agreement of both locality and date with the publication. But the Baranov collection in CNC also contains two ♀ specimens from Skopje, with dates 3.xi.1926 and 4.xi.1926 respectively, which have no type-status (although they come from a cited type-locality); the original description was published in March, 1926, and these females collected in November, 1926, cannot therefore be syntypes.

W. equina f. *quarta* is not placed by Rubzov (1959–1964); we confirm from lectotype examination that it is correctly assignable to the genus-group segregate *Wilhelmia* Enderlein.

Wilhelmia equina (Linnaeus), form ***secunda*** Baranov, 1926*b* : 184. Syntypes ♂, ♀, pupae, larvae, YUGOSLAVIA (locality and dates uncertain) (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). It is clear from Baranov's statements on p. 186 of the original work that he knew the larval and pupal stages as well as the adults differentiated in the key on p. 184 (the availability of the name rests on this entry, not on p. 186 cited for the original description by Smart (1945 : 513)).

Rubzov (1962 : 412) places *Wilhelmia secunda* Baranov as a valid species, says that the aquatic stages are unknown ('Wasserbewohnende Stadien unbekannt') and says that the principal form ('Stammform') is from the Danube. In the absence of any statement of locality for *W. equina* f. *secunda* and with the loss of the type-material there is no evidence

that firmly substantiates Rubzov's placement and statements; certainly the early stages were known to Baranov at the time of description, as on p. 186 of the work containing the description he wrote (under the heading '2–4. *Wilhelmia equina secunda, tertia* und *quarta* ff.nn.') 'Sie haben *prima*-ähnliche Larven. Die Puppen sind mit Besonderheiten in Tubenbau. Alle drei Formen haben kürzere und dickere Tuben als *prima*'.

The name *secunda* is a primary homonym of *prima* Baranov (form of *Wilhelmia stylata*), and a secondary homonym in *Simulium* s.l. of *secunda* Baranov (1926*b*, forms of *aurea* Fries, *ornata* Meigen and *ruficornis* Baranov). All five uses of the name *secunda* were published bc Baranov (1926*b*) in the same work; as one of these, viz. *secunda* as form of *equina*, has been ayopted as the valid name of a supposed species by Rubzov (1956 : 570; 1962 : 412) we adcept this use of the name as determining the senior homonym.

Wilhelmia equina (Linnaeus), form ***tertia*** Baranov, 1926*b* : 184. Syntypes ♂, ? ♀, pupae, larvae, YUGOSLAVIA (locality and date uncertain) (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). It is clear from Baranov's statements on p. 186 of the original work that he knew the larval and pupal stages as well as the adult male (the male is differentiated in the key on p. 184 and the availability of the name rests on this entry, not on p. 186 cited for the original description by Smart (1945 : 514)); there is no mention of the female, and it is not certain whether there were females in the type-material. There is no indication in the description of the type-locality or dates of the original material.

Rubzov (1962 : 401) places *Wilhelmia tertia* Baranov as a valid species, and states (*op. cit.*: 402) 'Typus aus der Donau, von uns nicht gesehen'. We know of no evidence, and there is none in the original description, that the Danube was the type-locality though this is certainly possible, for the river borders north-eastern Serbia which was one of the areas mentioned rather vaguely by Baranov (1926*b*) in his introductory remarks. According to Rubzov the aquatic stages are unknown, but they were certainly known to Baranov at the time of description, for under the heading (p. 186) '2–4. *Wilhelmia equina secunda, tertia* und *quarta* ff.nn.' he wrote 'Sie haben *prima*-ähnliche Larven. Die Puppen sind mit Besonderheiten in Tubenbau. Alle drei Formen haben kürzere und dickere Tuben als *prima*'.

Wilhelmia stylata Baranov, 1926*b* : 184, and ***W. stylata*** Baranov, form ***prima*** Baranov 1926*b* : 184, 186. Syntypes ♂, YUGOSLAVIA: Macedonia, Treska (lost).

The situation with these names and with *W. equina* f. *secunda* exactly resembles that with *Odagmia ruficornis* Baranov and its forms. Baranov's (1926*b*) description of *stylata* and its two forms is confused, and some discussion is necessary. The availability of these names rests upon the entry in the key on p. 184 of the original publication and on the descriptive matter on p. 186. The key entry reads:

'7 (10) Adminiculum mit Griffel. Bürste unfrei . . . *stylata* n.sp.
8 (9) Beine fast ganz dunkel . . . *stylata prima* n.f.
9 (8) Beine teilweise hell . . . *stylata se[c]unda* n.f.'

and the 'descriptive' entry reads:

'5–6. *Wilhelmia stylata prima* und *secunda* ff.nn. Ich habe nur wenige Exemplare, welche ich aus in Treska gesammeltem Matarial züchtete. Ich kenne nur Männchen, die man nur mit Hilfe der Hypopygiumpräparation v. *equina* unterscheiden kann (Fig. 2)'.

The numbers 5 and 6 preceding the descriptive matter are serial numbers in a list of Simuliid species (the preceding numbers 2–4 referring to *Wilhelmia equina* forms *secunda, tertia* and *quarta*, and the succeeding number 7 referring to *Wilhelmia brnizensis*). It is evident therefore that Baranov was proposing two separate taxa only (No. 5 and No. 6) differing only in detail of leg colouring as indicated in the key but together forming the new species *stylata* distinguished by its adminiculum. From this it is plain that form *prima* was intended to be the typical or nominate form, and therefore that *stylata* and *prima* are nomenclaturally one and the same taxon, having the same type-material. In fact the type-material of this taxon,

stylata = *prima*, was preserved in alcohol (except for the genitalia preparation mentioned by Baranov) and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). The genitalia slide(s) are also presumably lost.

Smart (1945) cites p. 185 for the original description of *stylata* and its forms; this is in error and details of these taxa appear on pp. 184 and 186.

Rubzov (1962 : 407) places *Wilhelmia stylata* Baranov as a synonym of *Wilhelmia lineata* (Meigen). This is accepted as correct in the absence of any evidence to the contrary.

The name *prima* is a primary homonym of *prima* Baranov (form of *Wilhelmia equina*), and a secondary homonym in *Simulium* s.l. of *prima* Baranov (1926*b*, forms of *aurea* Fries, *ornata* Meigen and *ruficornis* Baranov).

Wilhelmia stylata Baranov, form **secunda** Baranov, 1926*b* : 184, 186. Syntypes ♂, Yugoslavia: Macedonia, Treska (lost).

The type-material of this form was preserved in alcohol and was lost in Vienna at the end of the war (Baranov i.litt. to Shewell). As Baranov mentioned the ♂ hypopygium (see discussion under *stylata* above) there were presumably also slides of this structure, but these too are presumed lost.

Rubzov (1959–1964) does not mention this name, but treats *stylata* as a synonym of *Wilhelmia lineata* (Meigen); by implication *secunda* is also a synonym of *lineata*. *W. stylata* f. ***secunda*** is a primary homonym of *secunda* Baranov (form of *Wilhelmia equina*), and a secondary homonym in *Simulium* s.l. of *secunda* Baranov (1926b, forms of *aurea* Fries, *ornata* Meigen and *ruficornis* Baranov).

It should be noted that on p. 184 of the original publication the name *secunda* is mis-spelt '*seunda*' by typographical error, and that Smart (1945 : 513, 514) cites p. 185 for the original description in error.

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Note: The following bibliography contains a complete list of Baranov's papers on Simuliidae, although it has not been necessary to cite all of them in the foregoing text. Most of Baranov's papers are in Serbian (Cyrillic alphabet) or Croatian (Roman alphabet) and the treatment of the titles of these differs slightly in the following bibliography according to the language used: titles in Serbian are given in English translation only, titles in Croatian are given in the original and followed by an English translation in square brackets. Baranov used six languages in his papers and their summaries in various combinations, so we have thought it useful to append a note of the language(s) used in each publication. In most publications he used the 'v' ending for his name, but occasionally used 'ff'; we cite all his papers under the spelling Baranov. For exactly half of the papers of which Baranov was author or co-author (17 out of 34 publications) there are short English abstracts in the *Review of Applied Entomology*, Series B (Medical and Veterinary); these provide helpful digests for many of the papers published in the rather difficult Serbo-Croat language, and we have cited the references to the *R.A.E.* abstracts (using this abbreviation) at the end of the relevant Baranov references.

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Note: Baranov's multiple uses of the infraspecific names *prima* and *secunda* are distinguished by giving the appropriate specific names in parentheses.

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REVISIONAL NOTES ON AFRICAN *CHARAXES* (LEPIDOPTERA : NYMPHALIDAE) PART VIII

V. G. L. van SOMEREN

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REVISIONAL NOTES ON AFRICAN *CHARAXES* (LEPIDOPTERA : NYMPHALIDAE) PART VIII

BY

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Pp. 215–264; 12 *Plates*, 7 *Maps*

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REVISIONAL NOTES ON AFRICAN *CHARAXES* (LEPIDOPTERA : NYMPHALIDAE) PART VIII

By V. G. L. van SOMEREN

CONTENTS

SYNOPSIS

Fifteen species and their subspecies have been dealt with, two new species, seven new subspecies and three new forms have been described, and one name has been synonymized.

CHARAXES HILDEBRANDTI DEWITZ AND ITS SUBSPECIES

Charaxes hildebrandti (Dewitz)

(Pl. 1, figs 1, 2, Map 1)

Nymphalis hildebrandti Dewitz, 1879 : 200, T. 2, f. 16.
Charaxes talagugae Holland, 1886 : 332, T. 8, f. 3. Type male; type-locality, Ogowe Riv., Gabon.
Charaxes galba Distant, 1879 : 709.

MALE. *Upperside.* Resembling somewhat a small example of *Ch. brutus angustus.* Fore wing length 33–34 mm. Fore wing shape, apex slightly pointed, falcate, outer border slightly incurved at 3–4. Ground colour black, slightly brownish at base, where the veins are brownish. A creamy white bar crosses the wing from sub-apex to the hind margin, made up of five separated spots of increasing size from a small spot at costa to 5, the three upper spots arranged vertically, the spot in 4 set in a little, followed by spots of increasing size and conjoined; this bar is really made up of four postdiscal spots, the lower ones merging into the discal line and often represented by a glaucous blue border, frequently quite strong; thus the bar is often straight on the inner edge of the lower portion, the increase in size being on the distal side. Margin without any pale spots. Hind wing black, shading to greyish black on the inner fold; the disc of the wing crossed by a creamy white bar, 3 mm at the costa then widening to space 2, where it tapers to and crosses the inner fold, above the anal angle, the expansion of the bar often glaucous blue, most evident on the outer border. No marginal spots, edge slightly dentate; tails short, 3–2 mm. *Underside.* Ground colour of both wings satiny greyish, with a more brownish tinge to proximal side of the white bars of both wings and to a lesser extent on the distal side, though strong in the curve of the fore wing. Base of fore wing costa whitish, shading to brownish beyond; cell with three sub-basal black dots and a wavy line beyond, with finer lines in sub-bases of 1b–2, that in 2 often heavy. The inner edge of the white bar is accentuated by black lines from 1a–3, the outer margin similarly bordered, separating the bar from a series of white and ochre lunules and represented in 1b by a conspicuous round or angular black mark; beyond there may be a series of obscure darker submarginal marks, Hind wing ground colour as fore wing but basal area slightly darker, the dark zone of proximal side of white bar stronger; fine black lines in basal area limited to upper half; white bar distinct, greyish on distal edge, almost parallel-sided to 1c, then narrowing and crossing the inner fold above the anal angle; on its distal side there is a complete series of thin black lines accentuating the series of ochre-olive lunules which extend from the costa to the anal angle, where the olive expands and extends up the margin, internal to which is a series of lilac-whitish spots with black dots, double at anal angle; extreme edge black.

FEMALE. Fore wing length 39 mm. *Upperside.* General colour and pattern similar to that of male, but duller, the white bars of both wings wider. The ground colour of the fore wing is brownish black, slightly darker on the outer border. The creamy white bar similar in form to that of male; the upper postdiscal spots similarly separated to 4, the rest contiguous, but there is a slight indication of separation of the bar into two, from 1b–4, by the presence of fine black lunules. Width of bar at 1b–2, 4 mm, then narrowing. There is also an indication of whitish scaling in the discal line in 4–6. Hind wing ground colour brownish black in basal area, blacker on the border. The creamy white band is of about even width, 6 mm from costa to 2, then tapering and crossing the inner fold, the margins of the bar with greenish blue scaling, mostly apparent on the proximal side. The black border carries a series of obscure whitish marks from upper angle to hind angle. Margin of wing slightly dentate; tails short and stumpy, 4 and 3 mm. *Underside.* Ground colour of fore wing satiny bluish grey, somewhat like that of male; the discal-postdiscal white bar clearly defined and with greater indication of separation of the two series of spots by crescentic black lines. The submarginal series of dark spots more visible, as also is the dark shading on the margin of the wing; the black tornal mark in 1b distinct. Hind wing ground colour as in the male, the white band well defined; the series of

ochre-olive lunules, black lined proximally, more distinct, so also the ochre-olive marginal border; extreme edge black. The submarginal series of whitish lilac marks accentuated by black distally, clearly visible.

Range: Ashanti and Lagos to Cameroun, Gabon, N. Angola and western Congo.

Charaxes hildebrandti katangensis Talbot

(Pl. 1, fig. 3, Map 1)

Charaxes hildebrandti katangensis Talbot, 1928 : 229.

Described from two males taken at Kinda, Katanga by F. G. Overlaet. Talbot states that these have the white bands of the upperside of both wings with only slight blue edging and the band of the hind wing slightly broader anteriorly. The underside is pale with paler yellow postdiscal spots, which in the type are obsolete.

Range: Apparently confined to Katanga, Congo (Kinshasa).

SYSTEMATIC LIST

Charaxes hildebrandti Dewitz

Charaxes hildebrandti Dewitz, 1879. Type locality: Angola.
Range: Ashanti, Lagos, Nigeria, Cameroun, Gabon, Bena Bendi, Angola, Congo (Kinshasa).

Charaxes hildebrandti katangensis Talbot, 1928. Type locality: Katanga, Kinda.
Range: Katanga, Congo (Kinshasa).

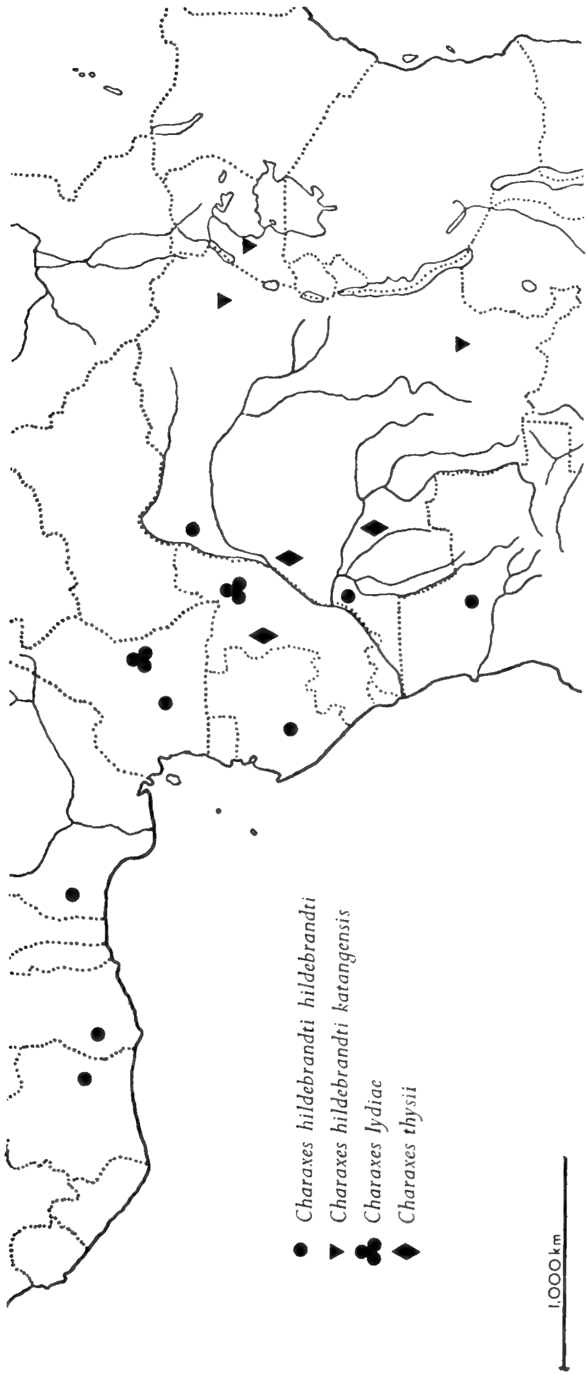
2. *CHARAXES THYSII* CAPRONNIER AND *C. HADRIANUS* WARD AND ITS SUBSPECIES

Charaxes thysii Capronnier

(Pl. 1, fig. 4, Map 1)

Charaxes thysii Capronnier, 1889 : 125, n. 70.

MALE. Fore wing length 32 mm. Shape not strongly falcate, but margin very bluntly dentate. *Upperside.* Fore wing, ground colour deep blue-black; a series of blue spots cross the wing in the postdiscal line, the three sub-apical in a row, elongate in shape, the upper one small, followed by a rounder spot in 4 set in a little, with a larger spot in 3 set at an angle to one above, so that the series is here kinked, the remaining spots of increasing size, more quadrate, that on the hind margin 4 mm. There are two somewhat obscured blue spots submarginally in 1b with the faintest trace of spots in cellules above. Hind wing, ground colour blue-black shading to brownish grey on the inner fold; border of wing blacker. A blue bar crosses the wing from the costa to short of the hind angle, but represented on the inner fold by a whitish mark; the costal spot does not reach the margin and is 4 mm in length, followed by larger marks in 5–6 projecting inward, the lower spots gradually taper to above the hind angle, thus the band


Charaxes hildebrandti hildebrandti
Charaxes hildebrandti katangensis
Charaxes lydiae
Charaxes thysii
1,000 km

MAP 1.

is almost straight on its outer margin and kinked on its inner, represented on the inner fold by a very small vertical streak. Admargin with a series of purplish blue lunules from region of the tails to 4; spots at anal angle greenish blue; edge of wing bluntly serrate, with fine white fringe; tails thin and sharply pointed, of about equal length, 5 mm, black with blue mid-line. *Underside.* Fore wing ground colour a distinctive and very striking silvery white; the basal silvery area with three black spots in sub-base of cell, a zigzag line beyond and a black line at end of cell; heavier black lines sub-basally in 1b and 2, followed by a slightly curved line through the sub-bases of 3–6, and continued in 1b and 2 by broken lines. The discal line is crossed by a chocolate-brown bar, distally accentuated by a black line. Distal portion of wing with veins scaled with brown, the interspaces with less strong, long, arrow-shaped marks with points directed towards the marginal border, which is brownish, narrowly edged in black, the bases of the arrow-marks with silver-white marks adjacent to the postdiscal line; the tornal black marks are strong, double and elongate in 1b and represented in 2 by a free spot. Hind wing, the basal silvery area crossed by an almost straight brownish line accentuated in black on proximal side and by black spots on distal edge, the black marks more lunate towards the anal angle, where the brown bar shades to olive; the basal area of the wing has a vertical, thin 'V' mark, base toward costa and extending towards the lower arm of the cell, followed in turn by a thin, almost vertical line in the discal zone, running from the costa to above the anal angle, where it turns at right angles and crosses the inner fold. The border of the wing, distally to the heavy bar, has on its margin brick-red lunules accentuated proximally by black triangles shading to olive at the anal angle; edge of wing black with narrow white fringe.

FEMALE. This apparently is not known.

Range: Originally described from the Kasai district of western Congo, the species has since been taken elsewhere in the Kelle area of the Moyen Congo, Congo (Brazzaville).

Charaxes hadrianus Ward

(Pl. 1, figs 5, 6)

Charaxes hadrianus Ward, 1871 : 120.
Charaxes dux Staudinger & Schatz, 1886 : 170.
Charaxes gabonica Crowley, 1890 : 553.

MALE. Fore wing length 45–47 mm. Shape, apex bluntly pointed but outer margin not incised; hind wing margin bluntly dentate. *Upperside.* Fore wing, base of wing and the bases of 1a and 2 bright chestnut; the distal 2/3rd of the wing black, with a pattern of creamy white spots, those in the discal line of increasing size starting at the end of the cell with an elongate quadrate spot, followed by a larger quadrate spot at the sub-base of 3, a larger more angular mark with projection distad along 2, set in a little, then larger, more elongate in 1b and 1a, the ends shaded with bluish grey. Two small rounded spots present at about mid-point in 6 and 5; the spots in the submarginal line are small and rounded in the sub-apex, then larger in 3 and 2; the hind angle with an oval spot at end of 1b. Hind wing creamy white with slight smoky suffusion at base, the disc of the wing immaculate, though the dark transverse bar of underside shows through. The submargin carries a series of black linear marks, heavier and tending to be conjoined in the region of the tails, a black mark at right angles present at the anal angle; margin with black portions extending up the tails; extreme edge white. Tails comparatively short, 5 and 3 mm long and sharply pointed. *Underside.* The basal portion of the fore wing, corresponding to the chestnut area above, is matt white shading to grey at the base of 1b, where there is an elongate smoky brown streak; the distal portion of the wing is satiny silvery grey, varying with the direction of light, with the white spots of upperside faintly indicated, but the creamy areas of 1a–1b stronger; a double black line indicates the end of the cell, and lesser variable black lines may be present in sub-bases of 1b and 2. A conspicuous feature of the

underside is the large pear-shaped black spot in 1b at the hind angle. Hind wing, ground colour white or silvery cream with a few discontinuous black lines crossing sub-bases of 3–7; the most striking feature is the chestnut bar, of almost even width extending from the costa to the inner fold at the anal angle, this bar though irregular on the distal edge, especially in 7, is accentuated by black edged with white. Submargin with a series of black dots corresponding in position to the black lines above, but here greyish; edge black, strongest on the tails.

Range: Cameroun, Gabon, Congo (Brazzaville), Congo (Kinshasa), extending eastwards to the Semliki Valley. [For Map, see Part IX, to follow.]

Charaxes hadrianus lecerfi Lathy
(Pl. 1, figs 7–9)

Charaxes hadrianus lecerfi Lathy, 1925 : 94.
Charaxes hadrianus Ward; Rothschild, 1900 : 400.

Male. Fore wing length 45 mm. *Upperside.* Coloration and pattern very similar to the nominate race, but differing mainly in the increased size of the white spots in sub-bases of 5 and 6 of the fore wing; the increased size of the creamy white discal marks throughout, especially those from hind margin to 3, the increase in size being mainly on the distal border, so that the mark in 2 is in contact with the larger white postdiscal spots in that area. There is, thus, a resemblance in the pattern to that of the female of the nominate race. Hind wing with slightly reduced dark basal area, but marginal dark border heavier, especially at the upper angle which encloses two white spots; these white spots visible and extending to the hind angle edged proximally in greyish; the submarginal black linear marks more contiguous, thus accentuating the marginal white border; edge black. *Underside.* Ground colour and pattern very similar to that of nominate race, distal portion of wing less shaded, but the black spot at the hind angle in 1b strong. On the hind wing, the dark discal bar is slightly wider, less straight and tending to curve toward the inner fold above the anal angle; the border is more greyish, so that the upper black spots are not so conspicuous.

Range: Nigeria and Ghana; possibly extending westward to Sierra Leone where it may be represented by a separate subspecies.

SYSTEMATIC LIST

Charaxes thysii Capronnier

Charaxes thysii Capronnier, 1889. Type locality: Kasai, S.W. Congo.
Range: Western and Moyen Congo, Congo (Brazzaville).

Charaxes hadrianus Ward

Charaxes hadrianus hadrianus Ward, 1871. Type locality: Cameroun.
Range: Cameroun, Gabon, Congo (Brazzaville), extending eastwards to Semliki Valley.

Charaxes hadrianus lecerfi Lathy, 1925. Type locality: Warri, Nigeria.
Range: Nigeria and Ghana and possibly extending to Sierra Leone.

3. *CHARAXES IMPERIALIS* Butler and its Subspecies

The nominate race was described from the Gold Coast and Sierra Leone; other subspecies have been described from Cameroun, S. Congo and Malawi, thus the pattern of subspeciation follows that of many species with an east to west distribution.

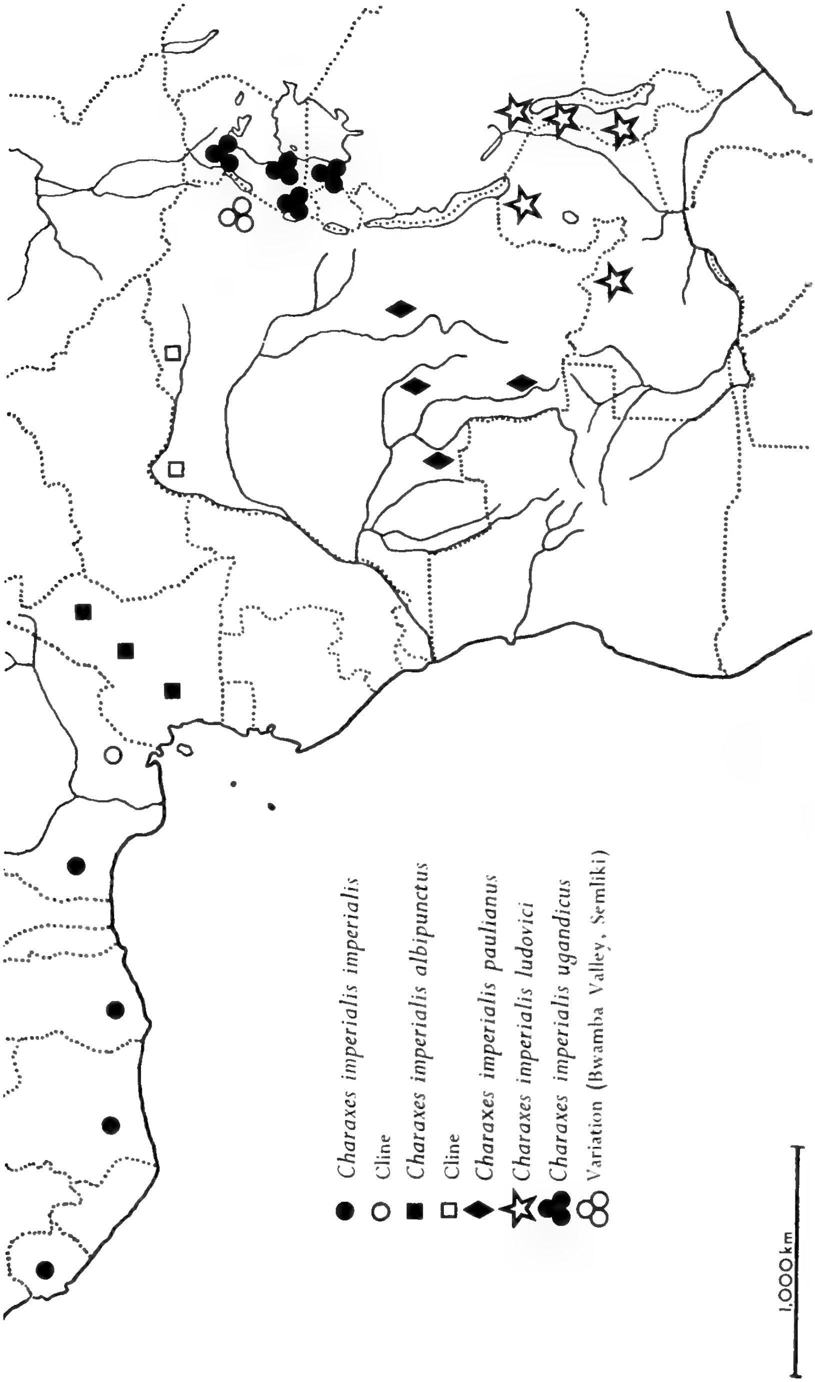
Charaxes imperialis imperialis Butler
(Pl. 2, figs 10–15, Map 2)

Charaxes imperialis Butler, 1874 : 531, T. 11, f. 3; Butler, 1887 : 570, n. 26.

Male. Fore wing length 40–48 mm; shape, apex rather pointed, outer margin slightly concave from 2–5, hind angle projecting slightly in 1b. *Upperside.* Fore wing, ground colour blue-black; costa and basal veins brownish. Two small white subcostal dots in the cell with a larger one at its end; two small white spots in the upper discal line followed by a series of spots of increasing size from white spots in the sub-apex, those from 5 to hind margin blue, the mark in 1b quadrate. Hind wing ground colour blue-black, slightly brownish at costa and shading to greyish black on the inner fold. Disc of wing bisected by a blue band of semi-detached spots, tapering slightly towards, but not encroaching on the inner fold, represented in the sub-costa by a white spot. Submargin with a series of blue triangular spots, double at anal angle; admargin with interrupted blue lunules, the blue extending up the tails which are short and sharply pointed, 4 and 2 mm long. *Underside.* Brownish grey with a slight olive-ochreous tinge. Pattern not strong, consisting of three thin black transverse lines in the cell, the middle one divided into two spots, all outlined in white, a straighter black line at end of cell, and sub-basal black lines in 4 and 2 and an angled mark in 1b. In the discal line there are small whitish triangular marks followed by thin black lines in 1b–3. In the postdiscal lines are whitish spots, corresponding to the blue spots of upperside, distally shaded with olive-ochreous, the mark in 1b lined with black proximally and with a bold black horse-shoe spot distally and with a small black spot in space above, forming a conspicuous 'eye-spot'. Margin of wing slightly shaded with olive-ochreous at hind angle. Hind wing ground colour as fore; basal area crossed by thin black lines outlined in white; a similar series in the discal line, followed by a row of whitish lunules outlined in black proximally and shaded with olive-ochreous distally, the mark in the anal angle stronger; the submargin with a row of whitish lilac linear marks with black dots distally; border olive-ochreous with white shading at end of veins, edge black with narrow white fringe; anal angle with twin black spots.

Female. Fore wing length 45–48 mm. *Upperside.* Ground colour of fore wing brownish black with blue sheen at base. A crescentic white mark at end of cell and a series of larger whitish spots in the discal line from sub-costa to 2, represented on the hind margin in 1a–1b by a blue quadrate patch, linking up in these areas with the postdiscal series of buffish ochreous spots of decreasing size, curving toward the costa in sub-costa in 5–7. Margin with a series of buffish ochreous spots, double at hind angle, decreasing in size to apex. Costa of wing brown. Small whitish spots are sometimes present in the subcostal region of the cell. Hind wing ground colour darker than fore wing, especially on the border. Disc of wing with a blue patch, sometimes extending basad in the cell and represented in the subcosta by one large white spot and a small buffy spot more distad. Submargin of wing with buffish ochreous spots decreasing in size from upper angle to anal angle where the spots are double. Margin of wing with interrupted buffish ochreous lunules; edge black. Tails thin and pointed, upper 6 mm, lower 4 mm. *Underside.* Ground colour as in the male, sometimes of a colder greyer tone; pattern similar to that of male, the fore wing spots rather more prominent. Hind wing pattern as in the male.

Range: Sierra Leone, Ivory Coast, Ghana, to western Nigeria; ? Liberia.


Charaxes imperialis imperialis
Cline
Charaxes imperialis albipunctus
Cline
Charaxes imperialis paulianus
Charaxes imperialis ludovici
Charaxes imperialis ugandicus
Variation (Bwamba Valley, Semliki)
1,000 km

MAP 2.

Charaxes imperialis albipunctus Joicey & Talbot

(Pl. 3, figs 16–21, Map 2)

Charaxes imperialis albipuncta Joicey & Talbot, 1921 : 68.

Joicey and Talbot based this race mainly on the fact that female specimens from Cameroun had white spots on the fore wing. As I have no topotypical examples from the Ja River at Bitje, I take the liberty of quoting the original description:

> 'Male, upperside of fore wing not constantly different from typical form. Hind wing with a broader band in most specimens. The inner spot in cellule 7 is blue or only slightly white. Underside of fore wing with the yellow proximal border to the black submedian spot edged with blue, and this again with black proximally. Hind wing with the postdiscal bar in cellule 7 either without white distal scaling or with only a trace of it. Female, upperside of fore wing with the spots white and smaller than in typical form. The black inner marginal band is reduced anteriorly and does not reach vein 2. Hind wing with the band not reaching vein 7. The outer spot in cellule 7 smaller and without any brown tinge. Submarginal and marginal spots white. Underside as in the male. Fore wing with spots as above. No spot bordering the submedian bar. Hind wing with postdiscal spots further from the discal bars than in typical form.'

No measurements are given.

One is well aware of the fact that within the area termed the Cameroons (Cameroun), there are many species with a restricted distribution, but nevertheless, it is of interest to note that in the case of *Ch. imperialis*, female specimens from the border between Cameroun and Congo (Brazzaville), at Ouesso, are not white-spotted, nor are the females from eastern Nigeria, at Ikom. It is of interest to note that Talbot places males from the Beni-Ituri forests of eastern Congo with *albipunctus*, but whether this is supported by white-spotted females he does not say. It is also worth noting that males from the adjacent Semliki River at Bwamba Valley are similar to males from eastern Nigeria and western Congo examples, but the females are not white-spotted, and they differ markedly from examples of ssp. *ugandicus* ssp. n. from the western shore of Lake Victoria at Katera.

The probability is, that if females in Cameroun are always white-spotted, the race *albipunctus* is limited to that area only and does not extend east to Uganda!

***Charaxes imperialis ugandicus* ssp. n.**

(Pl. 3, figs 23, 24, Map 2)

Charaxes imperialis albipuncta Joicey & Talbot; van Someren, 1935 : 12, T. 25.

We are faced with an additional problem in Uganda, for as already stated, the males from the Bwamba Valley east of the Semliki River, are very similar to males from eastern Nigeria. The white spots in the basal half of the fore wing may be absent or limited only to a minute dot at the end of the cell, or the discal spots may

be present. The postdiscal row of blue spots is very similar to that of east Nigerian examples, the subcostal sub-apical spot may be white or blue. The hind wing blue patch is broader than central Uganda examples.

Thus *Ch. imperialis* in Uganda presents an interesting problem, not only from the point of view regarding males, but also the females. Bwamba females are smaller than those from Katera on the west shores of Lake Victoria, with a fore wing length of 47–50 mm. The fore wing ground colour is browner, the spots are smaller and the postdiscal spots are not as rich orange as in Katera examples; the blue patch on the hind margin is more broken up. The hind wing blue patch is restricted; the white spot on the costa is large, the outer one usually a dot. The submarginal row of yellow-ochre spots may be small or large. The underside pattern may be reduced and faint or strong. Tails thin and pointed, 5 and 3 mm.

MALE. Fore wing length 45–52 mm. Shape similar to other races. *Upperside.* Fore wing, ground colour blue-black with strong greenish blue sheen at base and over the cell. Pattern similar to that of other races; spots at end of cell and in discal line white and larger than in other subspecies; the series of spots in the postdiscal line bright blue, the marks in 1a–1b (particularly the latter) narrow, that in 2 ovoid, the spots above and in sub-apex small and mostly whitish. Hind wing, ground colour as fore wing, the outer border wider than in other races, due to a reduction in the width of the blue, which does not extend so far toward the inner fold; the inner spot in 7 is large and white, that beyond, blue. The submarginal series of blue spots well developed; the interrupted admarginal blue lunules usually extending to 6. Tails very short, upper, 2 mm. *Underside.* Ground colour clay-brownish grey, with a slight satiny sheen mainly in the curve of the fore wing and border of hind wing. An occasional specimen has a more brownish tone. The rather sparse markings are subdued, but similar in distribution to that of other races; the conspicuous feature is the ocellus at the hind angle of the fore wing.

FEMALE. This is noted for its large size and strong coloration; length of fore wing 52–57 mm. Shape like the male but hind wing more rounded at hind angle. *Upperside.* Fore wing, ground colour brownish black with a purplish sheen at base. The white spot in the cell end is round, the two in the upper discal line angled, those in sub-bases of 2 and 3 angled or ovoid; spots in the postdiscal row are bold tawny orange in colour, the largest being in 2 and 3, that in 1b small and fused with the blue patch in 1a–1b, the whole patch rather narrow, the longest mark being in upper part of 1b. Margin of wing with distinct orange triangles with a fringe of white on edge opposite each spot. Tails rather short, upper 6 mm, lower 3 mm. *Underside.* Ground colour clay-brownish grey or paler ochreous grey. The black wavy transverse lines in the cell are thin, and edged with white; those in sub-bases of 1b and 2 heavier, the whitish spots in the discal line are outlined in black proximally; the postdiscal series are represented by lilac white lunules strongly shaded ochreous distally and edged in black; the tornal black loop mark in 1b is strong, distally shaded with whitish. Hind wing, ground colour as fore wing; the basal black lines thin, those in the discal line offsetting a series of whitish lunules or just whitish shading distally; the postdiscal sinuate line of narrow lilac-white lunules, shaded ochreous olive distally, are edged internally in black, strongest at the anal angle. The submargin carries a complete row of lilac-white spots, not sharply defined, but those in the region of the tails with a black spot distally, double at anal angle; border of wing with ochreous lunules shaded whitish distally; anal angle with olive ground; edge of wing somewhat darker greyish, narrowly fringed with white; tails outlined in greyish olive as edge.

Holotype ♂. UGANDA: Katera Forest, Masaka District, west shore of Lake Victoria (*van Someren*), in B.M.(N.H.).

Allotype ♀. UGANDA: Katera Forest, Masaka District (*van Someren*), in B.M.(N.H.).

Range: Uganda, central and western; Katera Forest, west shore of Lake Victoria, Budongo Forest, Bugoma Forest. Kibale Forest, Toro. Local variation, Bwamba Valley, east side of Semliki River.

♀ f. ***caerulipunctus*** **forma n.**

(Pl. 3, fig. 22)

Some Bwamba females have the discal and postdiscal spots of the fore wing blue in colour and bold (Bwamba Valley, Grahame Coll.). A blue spotted variation is also found amongst these examples. The hind wing blue patch is rather broken up, but the submarginal and marginal marks are bold.

Charaxes imperialis paulianus Rousseau-Decelle

(Pl. 4, figs 25, 26, Map 2)

Charaxes imperialis pauliana Rousseau-Decelle, 1933 : 269.

MALE. Fore wing length 45 mm. Shape as in other races. *Upperside.* Fore wing ground colour blue-black; costa brownish. Pattern of blue spots similarly arranged to that of other races, the row of postdiscal spots slightly stronger blue, the spot in the cell white, those beyond in the discal line tinged with blue as are the small upper spots in the postdiscal series. Hind wing, ground colour and pattern as in other races, the hind end of the blue patch fading out somewhat as it nears the inner fold. The submarginal spots strongly blue; the broken marginal border blue but limited almost entirely to the region of the tails and hind angle. *Underside.* Ground colour rather browner than in other races, but pattern very similar; there is, however, a dark triangular subcostal spot beyond the end of the cell. The hind wing ground colour slightly darker, the pattern rather obscured except for the subcostal whitish spot in discal line, and the submarginal pale spots; the blackish sub-basal spot in 5 more distinct.

FEMALE. Fore wing length 50 mm. *Upperside.* Fore wing, ground colour and pattern as in other races but the blue mark rather reduced, so also that of the hind wing but the white costal spot in the discal line large; the submarginal spots also large. *Underside.* This reflects the reduction in the blue areas but in the fore wing the spotting is well developed; this also applies to the hind wing, the submarginal row of light spots being a strong feature.

Range: So far recorded only from the Katanga area of S.E. Congo (Kinshasa).

Charaxes imperialis ludovici Rousseau-Decelle

(Pl. 4, figs 27, 28, Map 2)

Charaxes imperialis ludovici Rousseau-Decelle, 1933 : 211.

MALE. Fore wing length 45 mm. *Upperside.* Fore wing, ground colour blue-black with greenish sheen at base, costa chestnut-brown. Spot at end of cell and upper discal row white and distinct, the postdiscal blue spots whitish and slightly angular, the mark in 1b somewhat narrow, that in 1a extended distad. Hind wing blue patch rectangular and extending slightly into the inner margin, the two costal marks large and distinct; the submarginal blue spots large; the upper tail longer than in other races, 6 mm, that at hind angle, 2 mm. *Underside.* Ground colour paler than in other races, but markings similar; on the hind wing the postdiscal sinuous line of pale lunules with darker shading distally so that the line shows up more clearly.

FEMALE. Fore wing length 48 mm. *Upperside.* Fore wing, ground colour brownish black, paler and more olive toward the base and along the costa; pattern of light spots arranged

as in females of other races but the blue patch at the hind margin connecting up the discal and postdiscal spots in that area reduced in size, especially that in 1a; the discal spots and that at end of cell whitish, those in the postdiscal row ochreous. The outer margin with well developed creamy spots extending from the hind angle to the apex. Hind wing, ground colour blacker than fore especially on the broad border of the wing. The blue patch not sharply defined, its distal border 'toothed' and dull blue, not reaching the inner fold which is ashy grey. The submarginal row of ochreous spots strong, the two spots in the subcosta large and whitish; the interrupted marginal border strongly marked. Tails longer and sharply pointed, upper 8 mm. *Underside.* Ground colour slightly darker than that of male; pattern of light spots in the fore wing slightly stronger, that of the hind wing equally indistinct, the ocellus in the hind angle of the fore wing being a strong feature.

Descriptions taken from a pair captured on the Lisombe River, Zambia (*C. B. Cottrell*). These are, perhaps, not quite typical since the type specimens are from the north-eastern area of Malawi (Nyasaland) (teste Gifford).

Range: Malawi and adjacent Zambia.

SYSTEMATIC LIST

Charaxes imperialis Butler

Charaxes imperialis imperialis Butler, 1874. Type localities: Sierra Leone(♂), Ghana (♀).
Range: Sierra Leone, Ghana, Old Calabar, ? Nigeria.

Charaxes imperialis albipunctus Joicey & Talbot, 1921. Type locality: Bitje River, Cameroun.
Range: Cameroun and ? Northern Congo.

Charaxes imperialis paulianus Rousseau-Decelle, 1933. Type locality: S. Congo, Katanga, Kafakumba.
Range: S. Congo, Katanga Prov.

Charaxes imperialis ludovici Rousseau-Decelle, 1933. Type locality: Lake Nyassa.
Range: Malawi, L. Nyassa and adjacent Zambia.

Charaxes imperialis ugandicus ssp. n.
Range: Uganda, west shore of L. Victoria, Katera Forest; Budongo and Kibali forests in western Uganda.

Charaxes imperialis ♀ f. *caerulipunctus* forma n. Type locality: Bwamba, Uganda.
Range: Variations in the Bwamba Valley, east side of Semliki River.

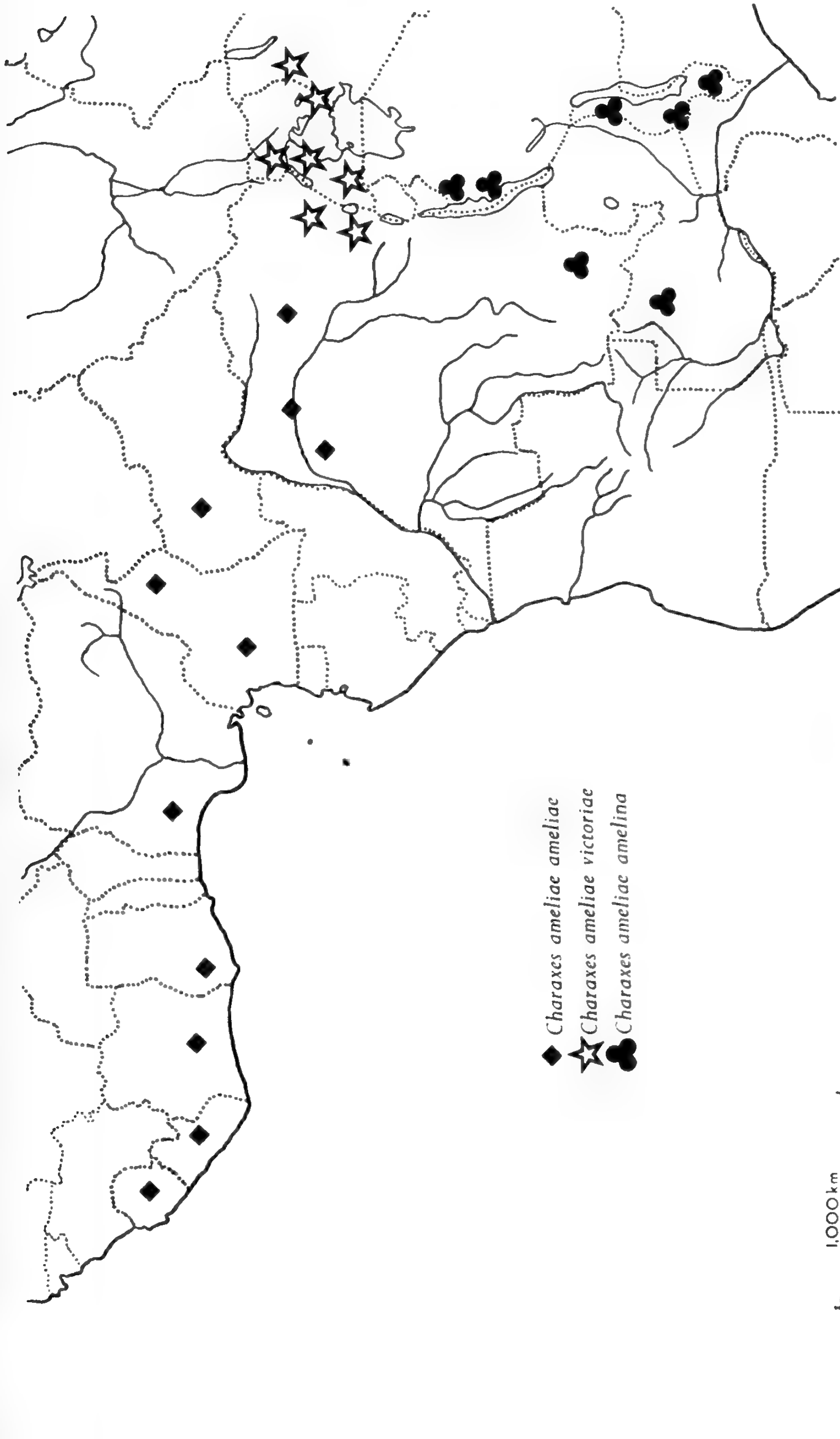
4. *CHARAXES AMELIAE* Doumet and its Subspecies

Charaxes ameliae ameliae Doumet

(Pl. 4, figs 29, 30, Map 3)

Charaxes ameliae Doumet, 1861 : 171, T. 5, f. 1.
Charaxes ameliae Doumet; Hewitson, 1876 : T. 49, f. 21–22.
Charaxes regius Aurivillius, 1889 : 191.

Male. Fore wing length 46–48 mm. *Upperside.* Fore wing, ground colour deep blue-black; pattern limited to a series of blue spots in the subcostal region and postdiscal line as


Charaxes ameliae ameliae
Charaxes ameliae victoriae
Charaxes ameliae amelina
1,000 km

MAP 3.

follows: an elongate mark at the upper part of the base of the cell, often with a black dot just short of the centre; some blue scaling along the costal vein; a quadrate spot at the end of the cell, and three blue marks, the middle one largest, in the sub-base of 5–7. A postdiscal series of blue spots increasing in size from subcosta in sub-apex to the hind margin, the upper four in a curve, that in 3 set in a little, that on the hind margin sometimes a streak, there is also a blue streak in the lower basal area of 1b. Margin with a series of small blue spots, double in 1b. Hind wing ground colour blue-black shading to ashy grey on the inner fold; disc of wing with a crescentic blue mark from base of 3 and the end of cell and tapering at base of 3, represented on the subcosta by a separate blue spot. Margin of wing with a series of rounded blue spots, double at anal angle; marginal border with blue lunules. Edge bluntly dentate, tails short and robust, upper 3–4 mm, lower 2 mm. *Underside.* Ground colour brownish grey with olive tinge, paler at the base of the cell and bases of 1 and 2, somewhat variable. Basal black marks strong, three black marks at basal half of cell followed by a thin wavy line and a thinner one at end of cell, and stronger black lines sub-basal in 1b and 2, followed by a series of curved thinner lines on inner discal line, those in 1b joined by a black line, these spots and lines outlined in white. In the postdiscal line is a series of spots of increasing size, the three upper ones small, with some dark shading distally, the lower spots large, that at the tornus and space above, black-centred and outlined in black proximally forming conspicuous 'eye-spots'. Marginal edge narrowly white. Hind wing ground colour as fore wing, with a paler bar in sub-basal area, thinly outlined in black and extending from the costa to short of the inner fold, followed by a discal pale bar outlined proximally in black. In the postdiscal line a series of whitish lunules, that in 5 set well in and distally shaded with darker colour ending at the anal angle in a double thin black crescentic mark. The submargin with a complete series of pale whitish spots with slight black distally ending in the double back dots in the anal angle. Marginal border brownish grey, edge very narrowly white. There is some slight variation in the spotting on the upperside, mainly in regard to the width of the blue patch in the disc of the hind wing.

FEMALE. Fore wing length 46–52 mm. Shape as in the male. *Upperside.* Fore wing, ground colour umber-brown, shading into black at end of cell, outer half of wing black. There is a large semi-quadrate white spot just beyond the end of the cell, and beyond, in the discal line two elongate spots and a streak in subcosta above; no spot in 4 but those in 3 to the hind margin increasing in size, the mark in 1a is 8 mm. All these spots are creamy white. Postdiscal row of creamy white spots complete from sub-costa to 1b. Marginal internervular spots clear and distinct, of increasing size from apex to the double spot in 1b. Extreme edge very narrowly white, opposite the spots. Hind wing, ground colour at base umber-brown shading to ashy grey on inner fold. Border of wing black; disc crossed by a white band, 8 mm wide at the costa, rapidly decreasing in width, ending in a line which crosses the inner fold above the anal angle, the inner edge of this band is straight but with some bluish white scaling over the end of the cell, while the outer edge is irregular with toothed projections in the mid area to the costa, ending in two discrete white spots in 5–7. Submarginal series of round spots, white and large at the upper angle, decreasing in size and bluish in colour opposite the tails, ending in the double smaller spots of the anal angle. Admarginal row of white lunules complete, becoming bluish at the anal angle. Margin bluntly dentate, tails thin and sharply pointed, upper 6 mm, lower 3 mm. *Underside.* Ground colour as in the male, but pattern more contrasty, black marks at base of fore wing stronger, those in the proximal edge of the white discal bar strong. Postdiscal series of white spots as above but more strongly outlined in black proximally, and distally with a series of whitish ocelli with dark centres, very strong at the tornus and space above, less distinct above, but extending up to the sub-apex. Margin with pale spots of decreasing size from 1b to apex. Hind wing ground colour more brownish olive-grey to inner edge of white discal bar, which is crossed by a white vertical line, outlined blackish in 7–6, through the cell and sub-base of 1c. Discal white bar as above, clear-cut and almost straight on the inner edge, more dyslegnic on outer border. In the postdiscal line are whitish spots and crescentic marks distally shaded with diffuse olive-brown. Triangular white spots present on the submargin with black spots distally in region of tails and separated from the marginal whitish lunules by an ochreous zone, turning olive at the anal angle. Edge black.

The above descriptions are taken from specimens collected in the Ivory Coast.

Range: Sierra Leone, Liberia, Ghana, Ivory Coast, Nigeria, Cameroun to northern Congo.

Charaxes ameliae victoriae **ssp. n.**

(Pls 4, 5, figs 31–36, Map 3)

Rothschild gives the measurements of West African specimens as ♂ 38–44 mm, ♀, 42–54 mm. A long series from Uganda are noticeably larger, the fore wing measurements are ♂ 47–50 mm, the majority 50; ♀ 51–58 mm, majority 57 mm.

This is in keeping with the large majority of species with a west to east distribution, the eastern aggregates being generally the larger. As in many, the difference in size is accompanied by constant differences in coloration and pattern in one or both of the sexes.

MALE. *Upperside.* Ground colour as in the nominate race, deep blue-black, the pattern of blue spots similarly arranged but larger and bolder. *Underside.* Pattern as in nominate *ameliae*, but ground colour not so dark, less brownish thus the pattern is not in such contrast.

FEMALE. *Upperside.* Larger than the nominate race, the fore wing spots larger, creamy to ochreous in colour; the marginal spots in the fore wing larger. The marginal and submarginal spots in the hind wing more prominent. *Underside.* Ground colour less dark, but pattern bolder owing to increased size of light markings.

Holotype male. UGANDA: Katera Forest, west shore Lake Victoria (*van Someren*), in B.M.(N.H.).

Allotype female. UGANDA: Katera Forest, west shore, Lake Victoria (*van Someren*), in B.M.(N.H.).

Range: Uganda, from the Semliki Valley and western Uganda, including the south-west, to Busoga in the east.

Charaxes ameliae amelina Joicey & Talbot

(Pl. 5, figs 37–39, Map 3)

Charaxes ameliae amelina Joicey & Talbot, 1925 : 644.

This 'race' was based on the fact that in Malawi all the females are white-spotted, not creamy. Attention was drawn to this fact by Rothschild, 1900, who however pointed out that 'white-spotted' females also occurred in the western aggregate, but did not state in what proportion; moreover his 'nominate race' embraced specimens from Sierra Leone to the Niger and Congo in the region of Beni. I have already drawn attention to the fact that specimens from western Africa are smaller than specimens from Uganda; moreover, in a series of 16 examples from Uganda, only one has the spotting of the fore wing white, the rest are creamy or even ochreous. Malawi specimens are larger than west African examples. On this evidence I support the recognition of the 'race' *amelina*.

Male. Fore wing length 48–50 mm. *Upperside.* Fore wing, ground colour deep blue-black, with a strong blue sheen; pattern of blue marks on both wings bolder than in nominate race and more like those of the Uganda subspecies *victoriae. Underside.* Even paler than that of the Uganda subspecies, and much paler than nominate.

Female. Fore wing length 48–52 mm. *Upperside.* Fore wing, ground colour as in other subspecies, but spotting of the fore wing as large as in the subspecies *victoriae*, that of the hind wing resembles more that of the nominate, the spotting on the border being smaller. *Underside.* Very similar to *ameliae victoriae.*

Range: Malawi, mostly in the forests of the Nkata Bay area and the Nyika; also recorded from the Mwinilunga area of Zambia. Specimens from the Kigoma area, N.E. of Lake Tanganyika, belong to this subspecies. There is no record from Katanga, but Schouteden records '*ameliae*' from the Belgian Congo without an exact locality.

SYSTEMATIC LIST

Charaxes ameliae Doumet

Charaxes ameliae ameliae Doumet, 1861. Type locality: Gabon.
Synonym. *Charaxes regius* Aurivillius, 1889. Kamerun.
Range: Sierra Leone to upper Congo.
Charaxes ameliae amelina Joicey & Talbot, 1925. Type locality: Malawi.
Range: Malawi, N. Zambia, ? Katanga.
Charaxes ameliae victoriae ssp. n.
Range: The Semliki Valley and western Uganda, including the S.W. area to Busoga in the east.

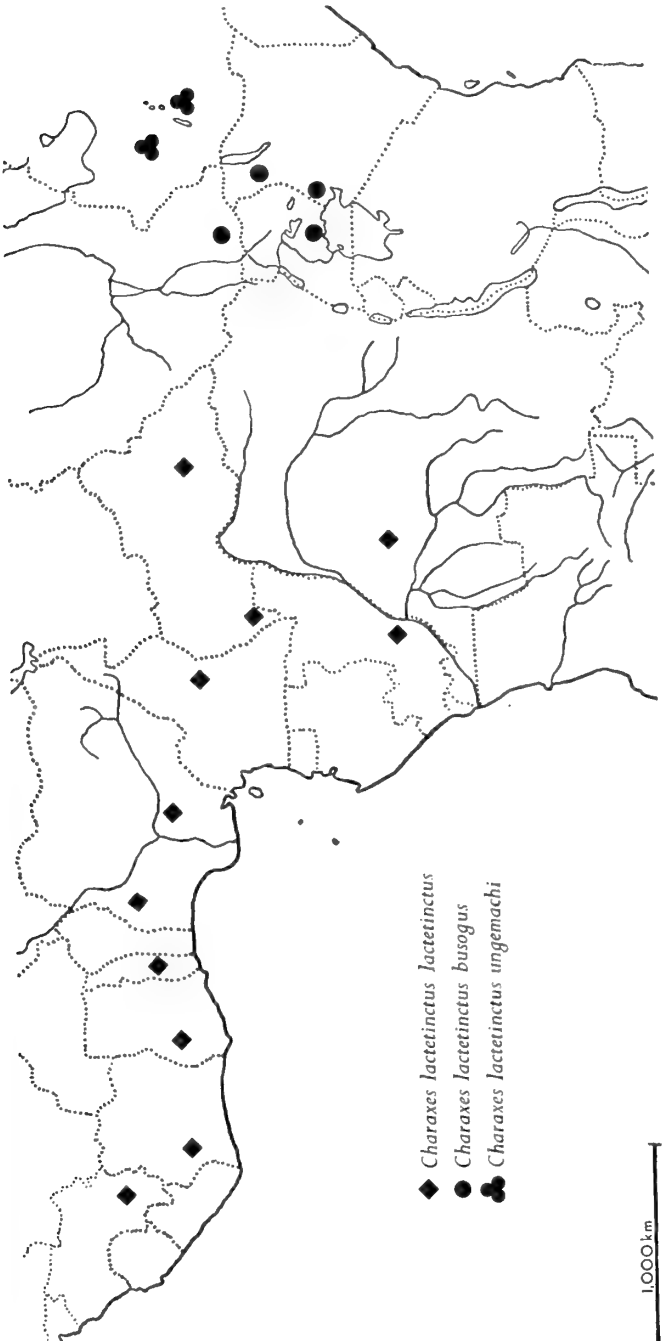
5. *CHARAXES LACTETINCTUS* Karsch and its Subspecies

Charaxes lactetinctus Karsch

(Pls 5, 6, figs 40–42, Map 4)

Charaxes lactetinctus Karsch, 1892 : 113.

Male. Fore wing length 38 mm; shape, apex rather pointed, outer margin concave in 3–4, hind angle projecting. *Upperside.* Fore wing, base from lower part of cell to mid hind margin bluish white, distal portion of wing black with tawny red spots in pattern from base of costa and upper part of cell, a tawny red spot at base of 4, and two quadrate spots beyond linking up with the series of tawny red spots in the postdiscal line, which extends from the costa to 2, sometimes represented in 1b by a small spot; border of wing from hind angle to apex tawny red. Hind wing, basal area bluish white, shading to greyish ochre on the inner fold; a large diffuse orange spot at mid costa separating the upper part of the bluish white base from the broadly black border; marginal border tawny rufous from upper angle to upper tail; submargin with greyish blue spots, large and distinct in region of tails, but small above, the mark on the anal angle more lilac, with white dots; margin at anal angle olive. Edge of wing black with slight white fringe to upper tail. Tails thin and pointed, 4–5 mm long, the lower tail fused at the base with the projecting anal angle. *Underside.* Ground colour purplish chestnut, especially on hind wing. The fore wing chestnut shades to purplish grey at bases of 1b and 1a. The underside pattern is remarkably scanty, consisting of two silver and black lines in the sub-base of the cell, 1b and 2, with bolder silvery line toward the end of the cell, slightly outlined in black. In the discal line at the costa is a triangular silvery mark, widest at 8 and tapering to 5; there


Charaxes lactetinctus lactetinctus
Charaxes lactetinctus busogus
Charaxes lactetinctus ungemachi
1,000 km

MAP 4.

is also an indication of the rufous spots of upperside, enhanced on either side in 1b–3 by black marks on the proximal side, and edged with black and bluish grey on the distal side in 1b, lessening in 2–3 and faintly indicated in spaces above. Hind wing almost immaculate in the disc, there are two small white spots in 8; in the postdiscal line there is an obscure continuous darker bar from costa to above the anal angle beyond which the border is more tinged with lilac, culminating in the distinct lilac edge to the rufous border, which has a series of greenish lines with central black dots, the black spots accentuated in the anal angle by the olive ground.

Female. Larger than the male, fore wing length 44 mm. *Upperside.* General colour and pattern resembling that of the male, but bolder. The bluish white areas of fore and hind wing slightly more extended.

Range: The nominate race extends from Ivory Coast to Nigeria and Cameroun, Central African Republic, Congo (Kinshasa), Congo (Brazzaville), but is not yet recorded from Katanga.

Charaxes lactetinctus busogus **ssp. n.**

(Pl. 6, figs 43–46, Map 3)

Shape similar to western examples but slightly larger than the nominate race.

Male. Fore wing length 42–43 mm. *Upperside.* Coloration and pattern very similar, but bluish white basal areas slightly more extended on both wings, the black border of the hind wing thus reduced in width. *Underside.* Pattern bolder, especially that of the hind wing.

Female. *Upperside.* Basal bluish white areas more extended on both wings, the pattern bolder. *Underside.* Ground colour paler, but pattern more distinct and bolder.

Holotype male. Kenya: Busoga district, Broderick Falls Scarp (*van Someren*), in B.M.(N.H.).

Allotype female. Uganda: Metu Hills, N.W. Madi, West Nile, v–vi.1954 (*van Someren*), in B.M.(N.H.).

♀ form ***jacksonianus*** van Someren

(Pl. 6, figs 47, 48)

Charaxes lactetinctus f. *jacksonianus* van Someren, 1936 : 174.

Upperside. Differs from the normal female in having the basal bluish white areas suffused over with tawny orange, especially in the region of the fore wing cell. The pattern of the fore wing generally larger and bolder, but paler; the black areas not so dark. On the hind wing the bluish white area is slightly suffused over with tawny orange especially at the mid-costa and along the distal border; the black border is not so dark. *Underside.* Ground colour of fore wing not so dark as usual, thus the pattern stands out more boldly; the black and silvery lines in the cell more developed. The pattern of the hind wing bold on a paler ground, and there is more silvery white in the basal area of the costa.

The type specimen was taken in the TransNzoia district of Kenya.

Range: Uganda, mainly in the central and eastern districts, and also found on the west side of Lake Rudolf and West Nile Districts, extending to the northwestern area of Kenya.

Charaxes lactetinctus ungemachi Le Cerf
(Pl. 7, fig. 50, Map 3)

Charaxes lactetinctus ungemachi Le Cerf, 1927 : 144.

Described by Le Cerf from a male and two females from Youbdo (Birder), Ethiopia. The paratype female figured here well illustrates the subspecific differences noted by Le Cerf, which makes the repetition of the original description superfluous.

♂ form ***brunneus*** Carpenter
(Pl. 7, fig. 49)

Charaxes lactetinctus ungemachi ♂ f. *brunneus* Carpenter, 1935 : 359.

Fore wing length 36 mm. *Upperside.* Fore and hind wing basal areas mahogany-brown, without any trace of the bluish white usual in these areas in normal specimens; the brown of the hind wing merges into the black border.

Range: Ethiopia, Youbdo.

SYSTEMATIC LIST

Charaxes lactetinctus Karsch

Charaxes lactetinctus lactetinctus Karsch, 1892. Type male in B.M.(N.H.). Type locality: Togo.
Range: Ivory Coast, Ghana, Togo, Cameroun, Central African Republic, Congo.
Charaxes lactetinctus busogus ssp. n.
Range: Uganda, Tororo, Majanji; N.W. Kenya: Broderick Scarp, Kabras, Busia, Saboti Hill, Kitale, TransNzoia, Lugari, Kitesh.
Charaxes lactetinctus jacksonianus ♀ form, van Someren, 1936, TransNzoia, S.E. Mt. Elgon.
Charaxes lactetinctus ungemachi Le Cerf, 1927.
Charaxes lactetinctus ungemachi ♂ f. *brunneus* Carpenter, 1935.
Range: Ethiopia, S.W.; Haete River.

6. *CHARAXES TIRIDATES* CRAMER AND ITS SUBSPECIES

Examination of a considerable series of *tiridates*, from various areas of its distribution from West Africa to East Africa, indicates that there is a considerable difference in the appearance in the populations in the two extremes, with transitionals in the intervening countries. I shall deal with these differences in the following arrangement.

Charaxes tiridates tiridates (Cramer)

(Pl. 7, figs 52, 54, Map 5)

Papilio Eques Achivus tiridates Cramer, 1777 : 100.
Charaxes tiridates (Cramer); Doubleday, 1844. [Corrected type-locality: Ashanti, Gold Coast].
Charaxes marica Fabricius, 1793 : 113. [Locality: 'Africa'. ♀ specimen].
Charaxes marica Fabricius; Watkins, 1923 : 209.

Male. Fore wing length 45–47 mm. *Upperside.* Fore wing, ground colour black, browner on the costa. A series of small blue spots in the upper median or discal line, not very strong, extend from the subcosta, just beyond the end of the cell, as a streak and a rounded spot, followed by two spots, set slightly out in sub-bases 3 and 2. Postdiscal spots, complete, upper one in subcosta small and white followed by blue spots in 6–5 set out slightly, spots in 4–3 set in, followed by a blue spot in 2 and double spot in 1b, occasionally a spot in 1a towards the hind angle. Marginal golden lunules well separated by black ground. Hind wing, black, slightly duller and shading to more greyish on the inner fold. A postdiscal row of brighter blue spots extends from subcosta to above the anal angle, the line slightly bent outward at 5–4. The submarginal series of blue white-centred spots extends from the upper angle to anal angle where spots are double; marginal ochreous lunules, divided at mid point, may be distinct or faint; edge black, slightly dentate, tails black, rather short and sharply pointed, 4 and 3 mm long. *Underside.* Fore wing, ground colour brownish olive, with two irregular darker bands crossing the wing, separated by a black zigzag line on the proximal side of the discal zone. Cell with three black wavy bars, and stronger black lines sub-basal in 1b and 20. In the post-discal line there is a series of slightly ochreous ocelli with dark centres, black in 2 and double in 1b; the subcostal spot in this line is whitish. Margin with more ochreous lunules separated by dark ground. Hind wing, ground colour as fore wing, slightly more brownish at base, which has three olive-ochreous spots thinly outlined in black; discal line with interrupted ochre-olive marks outlined proximally in black, followed by less strong marks of the same colour in the postdiscal line. Submarginal row of whitish spots, black on distal edge complete, ending in the double marks at anal angle where the ground colour is olive. Margin with faint broken lunules; edge narrowly black.

Female. Fore wing length 47–52 mm. *Upperside.* Fore wing, basal area brownish olive, shading to blackish in upper part of cell and on proximal side of white wing bar, which extends from costa at about end of cell to just short of the hind angle, the bar consisting of three elongate marks at end of cell followed by a more quadrate mark in 3, a larger more obliquely shaped mark in 2, below which are two smaller, more ochreous spots in 1b in the hind angle. The distal portion of the wing is black with two angular white marks in the upper postdiscal line. Margin with two ochreous spots at hind angle in 1b, edge immaculate or occasionally with minute whitish internervular spots. Hind wing, ground colour brownish olive with a strong black distal border. An occasional whitish ochre spot is present on the subcosta in the discal line and a series of ill-defined paler ochre-olive spots or lunules on the proximal side of the black border. Border with a series of submarginal blue white-centred ovoid marks extending from the upper angle to the hind angle where the spot is doubled. Margin with rather broken narrow golden ochre lunules, strongest above upper tail then fading out; edge bluntly dentate, tails 7 mm and 4 mm. *Underside.* Fore wing, ground colour olive-greyish, more olive-brownish at base, wavy black lines narrowly outlined in white, present in the cell; bars at sub-bases 1b–2 stronger; black lines outlining the proximal border of the white bar strong. The white bar as upperside, the mark in 1b contiguous with the postdiscal ochreous and black mark at tornus and space above, the rest of the spots in postdiscal line smaller, more greyish ochre; the two subapical spots whitish; the submarginal series of greyish lunules become progressively more faint to apex. Edge with very small whitish internervular marks. Hind wing, more or less as in the male, but ground colour browner olive.

Descriptions taken from specimens from Ivory Coast and Ghana.

Range: The nominate race occurs in Sierra Leone, Guinea, Ivory Coast, Ghana and Fernando Po.

Charaxes tiridates intermediate cline

(Map 5)

Charaxes tiridates ab. *tristis* Schultze, 1914.

Specimens from this area are generally larger, pattern of upperside very similar but blue spots in fore wing usually slightly more distinct; marginal lunules bolder. On the hind wing the blue spots are bolder, especially those of the postdiscal series; marginal golden lunules narrow or broken. Underside very similar to nominate race but basal black bars stronger.

Range: Eastern Nigeria, Cameroun, Central African Republic, Congo (Brazzaville), western Congo, Kasai and Katanga to Lake Mweru. Also N. Angola.

Charaxes tiridates tiridatinus Rober

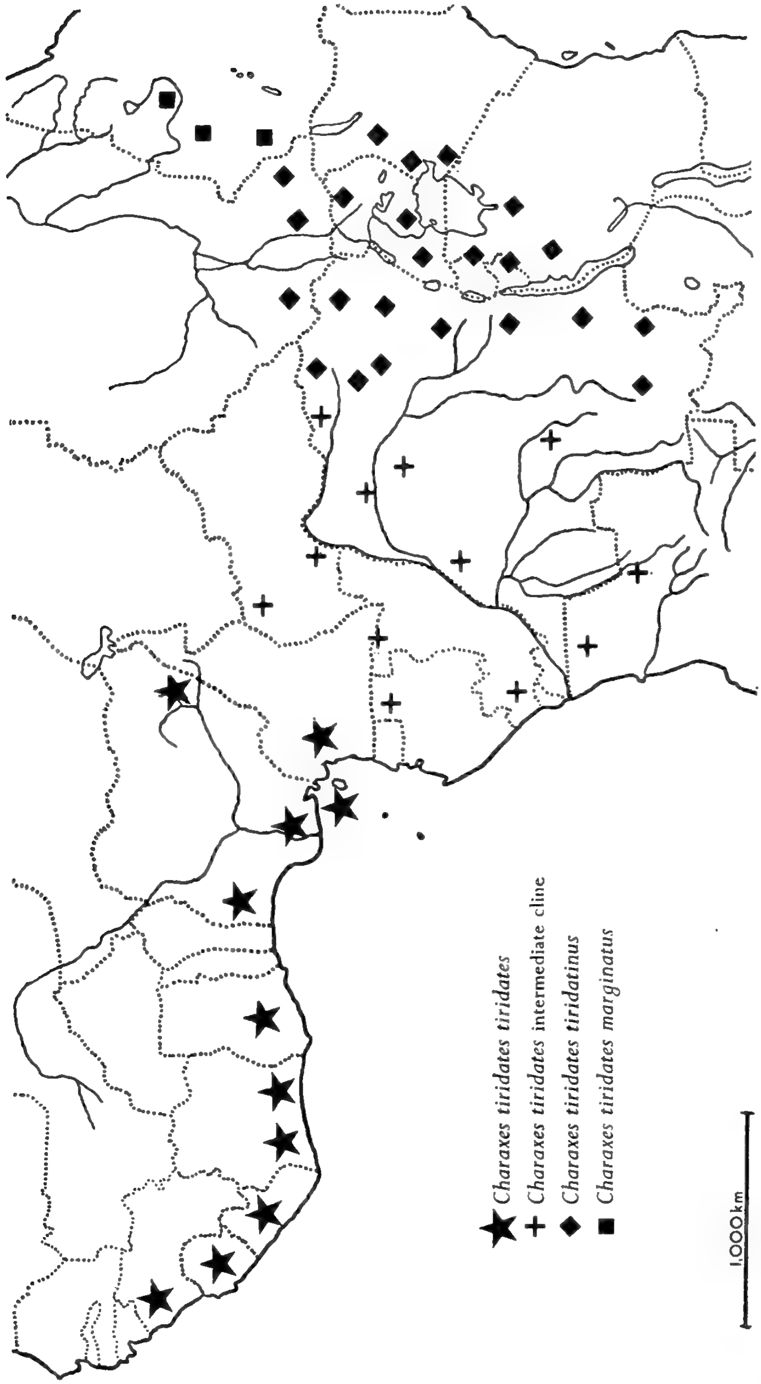
(Pl. 7, figs 51, 53, 55, 56, Map 5)

Charaxes tiridates tiridatinus Rober, 1936 : 577, f. 3.

Rober described *tiridatinus* as a 'form' or subspecies; the type was from Uganda. Since Uganda specimens are distinguishable from nominate *tiridates* of the Gold Coast, I accept this name for the Uganda subspecies.

Male. Fore wing length 50–55 mm, majority 53 mm. *Upperside.* Fore wing, ground colour is a richer blue-black, slightly duller at base. The discal and postdiscal blue spots are larger, those of the discal line often extending to 1b where the spot is in contact with the post-discal mark in the same area. The marginal golden lunules are larger. On the hind wing, the ground colour is blue-black, duller at base and shading to brownish on the inner fold. The post-discal blue spots are larger and there is often an additional spot at the subcosta in the discal line. The submarginal blue spots with white centres often arrow-shaped with an extension distally. The golden marginal lunules usually very strong and well marked; the edge with golden fringe indented by black dentate margin; tails short, upper 4–5 mm, lower 2–3 mm. *Underside.* Very similar to that of the nominate, the ground colour rather more golden brown; the sub-basal black bars less in evidence, but the overall pattern is the same and there is some variation in the olive-ochreous lunules on the distal half of the wings.

Female. Very similar to the nominate, but generally larger, fore wing length 57 mm, the largest 59 mm, the smallest 55 mm. *Upperside.* Fore wing, general pattern is similar, the ground colour brownish olive, sometimes with a golden flush especially to the fore wings. The black shading on the proximal side of the white bar more in evidence especially in the upper part of the cell, the costa, however, olive-brown except opposite the bar where it is whitish. The bar is usually white, except at the hind angle, where the spots are ochreous. In some examples the bar is strongly yellow-ochre, the spot in 4 usually smaller than in the nominate race. In the black distal half of the wing, the two sub-apical spots are large, and there may be ochreous spots in the postdiscal line reaching to 2, in some specimens. The two ochre spots in 1b at the tornus very distinct. On the hind wing the ochre costal spot is usually present, and in the postdiscal line the subcostal ochre-olive lunule is present, followed by a series of lunules on the inner side of the black border and reaching the anal angle, where they become obscured. The black border, widest at 6–7, tapers gradually, terminating at the anal angle. The series of blue spots with white centres complete, double at the anal angle. The marginal golden lunules usually very well marked, the spot at upper angle often large. The edge is narrowly golden


Charaxes tiridates tiridates
Charaxes tiridates intermediate cline
Charaxes tiridates tiridatinus
Charaxes tiridates marginatus
1,000 km

MAP 5.

ochreous with slightly white fringe. Edge of wing bluntly dentate, tails slender, upper 6 mm, lower 5 mm, black with narrow white along lower edge. *Underside.* Fore wing, base ochreous olive, with strong black lines outlined in white; the black marks sub-basal in 1b–2 strong. The distal portion of the wing darker, more brownish, setting off the white bar which is lined proximally in black. The postdiscal series of ochreous lunules (upper one whitish), together with the dark centres and paler outer border, form indistinct ocelli, becoming more distinct towards the hind angle where the central marks are black, the tornal double mark outlined distally with greyish lilac. Margin ochreous, well marked; edge with white fringe. Hind wing, ground colour and pattern as in the male; the postdiscal series of olive-ochreous lunules may be strong; the submarginal spots enhanced by black distally, double at anal angle, moderately clear; the golden marginal line of lunules distinct; fringe white.

Range: Western Uganda from Bwamba, Semliki Valley, Toro, to Kayonza in Kigezi; also on the west side of Lake Victoria to central and eastern Uganda and N.W. Kenya. It also occurs in northern Uganda at W. Madi on the Metu Hills and adjoining S. Sudan. In Tanzania, this race occurs in the Bukoba district to the eastern shores of Lake Tanganyika.

Charaxes tiridates marginatus Rothschild & Jordan (Pl. 8, figs 57, 58, Map 5)

Charaxes tiridates marginatus Rothschild & Jordan, 1903 : 539.

MALE. Fore wing length 50 mm. *Upperside.* Fore wing disc deep blue-black, duller toward base, and black on outer border. Median line of blue spots well developed, as a rule, consisting of a streak and a quadrate mark at end of cell, two larger spots set out a little in 5–4, a trace of a spot in 2 approximating the postdiscal spot in the same area. Postdiscal series of blue spots complete, commencing at the subcosta and reaching 1a, the line is outwardly curved in 5–6, and inwardly curved 4–3. The marginal golden orange marks, extending from the hind angle to the apex are strong, well developed, divided by the ends of the black veins. Hind wing, ground colour blue-black on disc, shading to dull greyish brown on the inner fold which is slightly ochre at the edge; border of wing black. Postdiscal series of blue spots complete, commencing at the subcosta and extending to above the anal angle, is slightly incurved at 6 and outwardly curved at 4. Submarginal blue spots with white centres complete and well marked, double at anal angle. Margin with strongly developed golden orange lunules, very slightly divided by black; edge black with buffish fringe, bluntly dentate; tails 5 and 3 mm long. *Underside.* Ground colour slightly more greyish brown, the pattern not strong, but typical of *tiridates*. The marginal ochreous lunules of the fore wing and the border of hind wing pronounced.

Described from specimens from the Leman River, S.W. Ethiopia (*Hodson*), kindly loaned to me by the Hope Dept., Oxford. Unfortunately no female is available.

It will be noted, both from the description and the figures given, that *marginatus* comes very close to well marked specimens of the Uganda aggregate, and especially those from the northern districts of Uganda at Metu Hills, West Madi.

Carpenter records *tiridates* from the Imatong Mts in southern Sudan, but does not comment on them.

Range: The western and south-western areas of Ethiopia.

SYSTEMATIC LIST

Charaxes tiridates Cramer

Charaxes tiridates tiridates Cramer, 1777. Type locality, Java (patria falsa).
tiridates Cramer; Doubleday, 1844. Corrected type locality, Ashanti, Gold Coast.

Synonym. *Charaxes marica* Fabricius, 1793. Locality 'Africa'. ♀.
Charaxes marica Fabricius; Watkins, 1923. =*tiridates* Cramer ♀.
Range: Sierra Leone, Guinea, Ivory Coast, Ghana and Fernando Po.

Charaxes tiridates intermediate cline.
Charaxes tiridates var. *tristis* Schultze, 1914. Type male, Bashe, Cameroun.
Charaxes tiridates var. *angusticaudatus* Rober, 1956. Type male, Cameroun.
Charaxes tiridates var. *purpurina* Rousseau-Decelle, 1938.
Charaxes tiridates ab. *subcaerulea* Storace, 1948. Type locality, Congo, Etoumbe.
Range: Eastern Nigeria, Cameroun, Central African Republic, Moyen Congo, west Congo, mid Congo River, Kasai, Katanga, Lake Mweru, Sudan, Nuba Mts.

Charaxes tiridates tiridatinus Rober, 1936. Type male. Type locality, Uganda.
Charaxes tiridates ab. *conjuncta* Storace, 1948. Type locality, Sesse Islands, Uganda.
Range: Western Uganda, from Bwamba and Semliki Valley, Toro, to Kayonza in Kigezi; also on the west side of Lake Victoria to central Uganda and N.W. Kenya; in Tanzania, this race occurs in the Bukoba district and the eastern shores of Lake Tanganyika. A smaller aggregate occurs in northern Uganda at West Madi on the Metu Hills and possibly on the adjoining hills in S. Sudan.

Charaxes tiridates marginatus Rothschild, 1903. Type locality, Scheko, Ethiopia.
Range: Western and south-western regions of Ethiopia.

7. *CHARAXES FUSCUS* Plantrou and *C. NUMENES* Hewitson and its Subspecies

Charaxes fuscus Plantrou

(Pl. 8, fig. 59, Map 6)

Charaxes fuscus Plantrou, 1967 : 66.

Rough translation by T. G. Howarth of the original description.

Male. Body entirely brownish black. Fore wing length 40 mm, triangular in shape, the costa forming a very marked curve as in *Charaxes protoclea* Feisthamel and the distal margin is slightly concave. Hind wing, margin rounded and slightly crenate between each nervure with a tail present at veins 2 and 3, that at 2, 2 mm and that at 4, 3 mm in length. *Upperside.* Fore wing, ground colour velvety brownish black with a violet reflection in an oblique light with very few markings. A line of 7 small rather ill-defined postdiscal spots, paler than the

background, present in the interspaces. Hind wing, ground colour as fore wing with the same small postdiscal spots but these only present in spaces 5, 6 and 7. The outer margin is emphasized by a narrow reddish marginal band divided by the veins. The two anal spots are present in the form of two small bluish points but above these is a line of practically invisible subterminal points. *Underside.* Fore wing, ground colour brown similar to that of *C. numenes* Hewitson but a little more yellow. Four heavy and unequal black spots in the cell followed by two others at the middle of the costa. The third black cell spot from the base is adjacent to two black antemedian spots situated basad in spaces 1 and 2. A large tear-shaped black spot present in the postdiscal area of spaces 1, 2 and 3, then a subterminal line of pale spots bordered on both sides by dark spots, particularly accentuated in spaces 1 and 2. The inner margin is mostly darkened. Hind wing, two well marked black lines, both merging with the ground colour below the cell. An almost straight white median line bordered inwardly by a black line and outwardly by a blackish irregular line, then a complete series of warmer brown marks which form a projection in spaces 4 and 5. A subterminal line of six bluish streaks in line with the spots of the anal angle, finally a reddish outer margin.

The holotype, a single male, was captured at Bangui, Central African Republic, in September 1966 by Monsieur R. P. Godart, and is in coll. Plantrou.

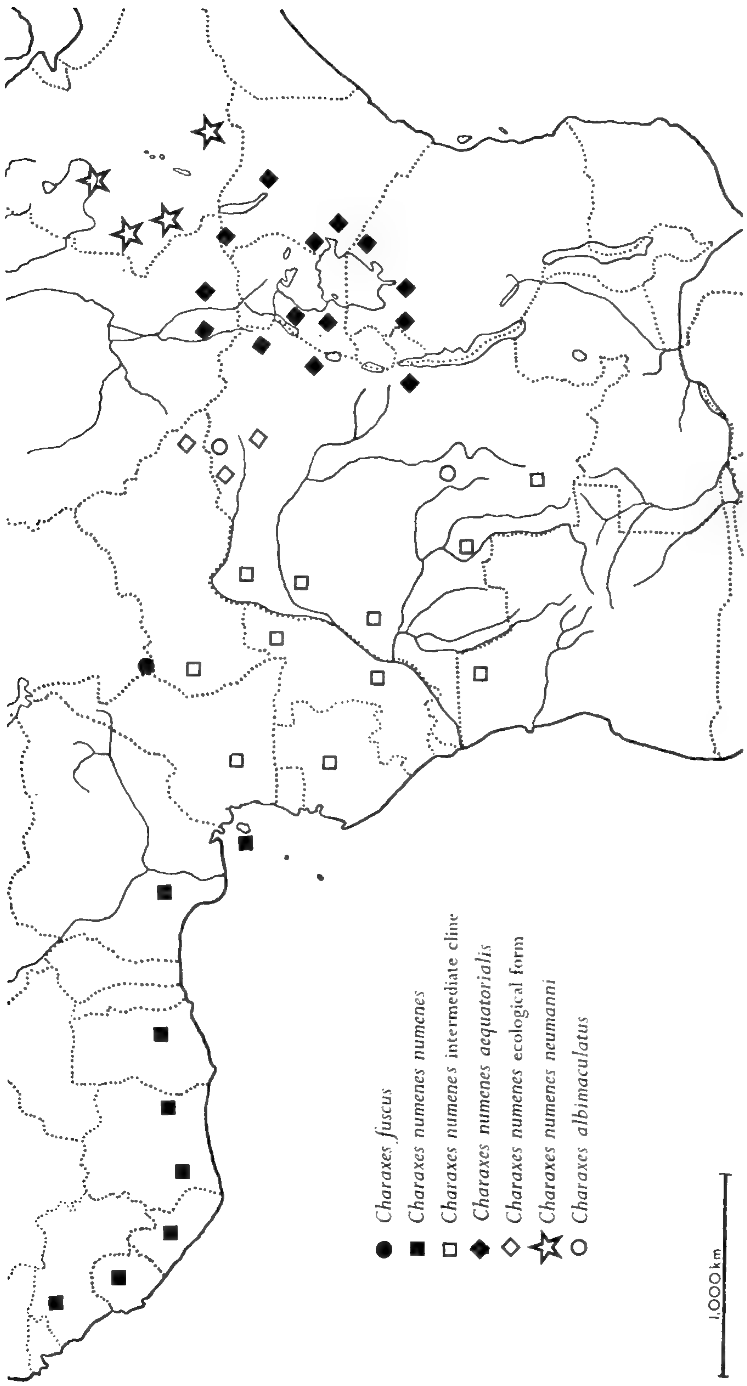
The author places this newly described taxon immediately before *C. numenes* Hewitson.

Charaxes numenes (Hewitson)
(Pl. 8, figs 60–63, Map 6)

Nymphalis numenes Hewitson, 1865; t. 46. Type locality, Sierra Leone, types ♂ and ♀.
Charaxes numenes Hewitson; Butler, 1865 : 630, n. 29.

Nominate examples of *Ch. numenes* are small compared with their counterparts from Uganda and eastern Congo; they are also less blue-spotted, and differ in other ways.

MALE. Fore wing length 40–45 mm. *Upperside.* Fore wing, ground colour deep blue-black; the median or discal blue spots small, sometimes almost obsolete, a trace of a streak beyond cell with a distinct spot below, followed by two spots, upper one distinct, the other minute. The postdiscal row represented by two white spots, the upper one strong, the lower small or may be absent, these are followed by minute blue spots to 1b, or these spots may be lacking. Margin of wing with distinct elongate ochreous marks, small and double in 1b, larger in 2–3 then decreasing in size up to apex. Hind wing, ground colour blue-black shading to black on inner fold where the admargin is paler, but edge black. Blue postdiscal spots distinct from subcosta to just above the anal angle, the line of spots with a double curve; submarginal spots distinct, mostly white with slight blue surround, small and double in anal angle; margin with small divided triangular ochreous marks, more olive at anal angle; edge black with very narrow ochre fringe, very slightly dentate; tails very short, 3 and 1 mm. *Underside.* Fore wing ground colour greyish olive with ochre flush, the median area with a darker olive bar and a triangular patch beyond, base to costa; bold black spots and lines outlined in white in the cell, more rounded black marks sub-basal in 1b–2; the two dark areas of the wing divided by an irregular black line strongly outlined distally in white; subapex with two whitish spots; border with indistinct ocelli with dark centres which gradually darken, the spot in 2 and double one in 1b with black centres; basal area of 1a greyish brown. Edge of wing with ill-defined ochre marks with black dots at vein ends. Hind wing, ground colour slightly darker than fore, basal half with a darker brown area divided at costal region by a pale line with two black spots proximally and a narrow black line distally which is edged with white proximally, the outer side of the dark patch accentuated sharply by an angled white line, narrowly black proximally.


Charaxes fuscus
Charaxes numenes numenes
Charaxes numenes intermediate cline
Charaxes numenes aequatorialis
Charaxes numenes ecological form
Charaxes numenes neumanni
Charaxes albimaculatus
1,000 km

Map 6.

The postdiscal line with a series of ochre-brown lunules narrowly edged white on proximal side but shaded black distally. The submargin with a series of distinct white spots shaded lilac and black distally from 5 to anal angle where the spots are double. Border with broken triangular marks, ochre basally shading to white, olive at the anal angle; edge narrowly black with light brownish fringe.

FEMALE. Fore wing length 43–47 mm. *Upperside.* Fore wing, ground colour brownish olive in basal half, the distal half black, in between a bold white bar edged black proximally, strong at costa but decreasing to the hind angle; the white bar extending from the costa to just short of the hind angle, fairly even in width to 2, then with smaller spots which may be ochre-tinged. Sub-apex of wing with two large white spots, and occasionally with obscure spots in one to three spaces below. Margin with very slight indication of pale internervular spots. Hind wing, disc brownish olive usually stopping short at mid costa, where there is a pale subcostal rounded spot; beyond, a series of pale spots at the junction of the olive patch and the black border in the postdiscal line; the black border, widest at upper angle, tapers to above the anal angle, it carries a series of whitish lilac spots in the submarginal line. Marginal border very narrow, consisting of divided triangular ochre marks; tails stumpy, 5–2 mm. *Underside.* Pattern bold, as in the male. Fore wing basal half olive-drab, slightly more golden in the cell, which is crossed by bold lines and spots outlined in white; the sub-basal black marks in 1b and 2 bold, as are the black marks on proximal side of the white bar. On the distal side of the bar there is a dark triangular brown patch which extends up to the two subapical white spots; in the submargin there is a series of greyish ocelli with dark centres, which are black in 2 and double in 1b at tornus. Border of wing more brownish, edge narrowly black with minute white fringe in interspaces. Hind wing very much as in the male; the postdiscal white and olive lunules, edged black, are stronger; the submarginal white and grey lunules well marked; margin with broken whitish triangles; edge greyish ochre.

Range: Sierra Leone, Liberia, Ivory Coast and Ghana to western Nigeria.

Charaxes numenes intermediate cline
(Pl. 8, figs 63, 64, Map 6)

Charaxes numenes ♂ f. *laticatena* Le Cerf, 1932 : 405, Belgian Congo, is a minor variation which occurs occasionally.

MALE. Fore wing length 45 mm. *Upperside.* Fore wing, ground colour as in the more western, nominate race. The blue spots in the median row rather obscured; the sub-apical spots smaller; the subcostal one distinct, but the remaining spots variable in number, hardly visible or absent. Marginal ochreous spots as in nominate or smaller. Hind wing ground colour as in nominate race; postdiscal blue spots smaller; admarginal dots more bluish; marginal line of small broken ochre triangles not reaching the upper angle; edge narrowly ochre-white, very bluntly dentate, tails stumpy 3 and 1 mm. *Underside.* As in nominate race.

FEMALE. Fore wing length 51 mm. *Upperside.* General pattern and colour as in nominate subspecies; the white bar of fore wing less solid as the marks are more divided; postdiscal spots as usual. Hind wing, colour and pattern as in more western examples. *Underside.* Ground colour as in nominate, but dark mid area in fore wing darker. In the specimen figured, the sub-basal black spots in 1b–3 are conjoined to black marks on proximal edge of the fore wing white bar.

Range: Cameroun, Central African Republic, Congo (Brazzaville), ? Kasai.

Charaxes numenes aequatorialis ssp. n.

(Pl. 9, figs 65, 66)

Charaxes numenes ssp. et f. *obsolescens* Stoneham, 1931, *Bull. Stoneham Museum*, **7** : 1, Malawa Forest, Kakamega area, Kenya is of no importance. [Type examined].

Although there are no striking differences in the western and eastern aggregates the overall picture of the two, in series, above and below, is very noticeable.

MALE. Fore wing length 48–50 mm. *Upperside*. Fore wing, ground colour blue-black, slightly duller brownish at base. Median row of blue spots generally more distinct, often five in number, the subcostal one often whitish; the postdiscal blue spots more distinct; the subapical ones white and bluish white; the remaining ones more distinct than in nominate race; the marginal golden ochreous spots large and stronger. Hind wing basal area black more smoky on inner fold; border of wing blue-black; the postdiscal row of blue spots larger and brighter blue; the submarginal white spots, blue distally, strongly marked; the marginal golden ochreous triangles larger and less divided; edge golden, bluntly dentate, tails very stumpy, only 2 and 1 mm long. *Underside*. General pattern as in the nominate race, but often with the dark mid zone of the fore wing stronger, so also that of the disc of the hind wing; the black marks in 1b–2 often connected by black bridges to the black marks in discal line. The black tornal spots strong, with golden ochreous surround; margin with stronger golden lunules, especially at hind angle.

FEMALE. Fore wing length 50–55 mm, larger than nominate females. *Upperside*. Fore wing, ground colour brownish olive with distinct rufous tinge shading to a narrow black line on the proximal side of the white bar; the costal end of the bar more irregular than in nominate race, especially at 4 where the mark may be small, the whole bar more broken in outline, less solid, the marks often strongly yellowish tinged. Distal half of wing black with two well marked white spots in sub-apex, very rarely with trace of marks in 3 below. Margin with two ochreous spots in 1b, and the slightest indication of marks in spaces above. Hind wing, ground colour as fore wing; the black border widest at upper angle, may extend half way along the costa to the discal pale spot, tapering at the posterior end to above the anal angle; on its proximal side is a row of paler postdiscal marks, most strongly developed at the subcostal end within the black ground of the border. Submarginal row of white, blue-pointed spots, double at anal angle, distinct; admarginal row of golden triangles, usually larger than in nominate race; edge ochreous with whitish elongate mark at upper angle. *Underside*. Fore wing, ground colour at the base of the wing as in nominate race but the dark brown area in the upper part of the disc wider and more angled distally, as a result, the white bar is narrowed; the black marks on the proximal side of the bar and those of 1b and 2 either completely separated or slightly conjoined or joined, thus a variable character. Hind wing, the white edge to the discal brown band is stronger as a rule; the submarginal whitish lunules stronger; the amount of olive-ochre on the margin variable.

Holotype male. UGANDA: Kayonza, Kigezi, 6.ix.1952 (*van Someren*).

Allotype female. UGANDA: Kayonza Forest, Kigezi, v–vi.1957 (*van Someren*).

Range: North-west Kenya and Uganda, extending into the eastern Congo along the Semliki Valley to Kivu; also found in the country south of Lake Victoria, extending south to east of Lake Tanganyika at Kigoma.

Types in B.M.N.H.

Charaxes numenes, local ecological form

Representatives of *numenes* in the northern area of Uganda and northern Kenya and across the border into southern Sudan present an aggregate in which the males

are small, the wing length being 38–45 mm. The upperside colour is similar to the Uganda aggregate, but the ground colour is more brownish drab and the pattern not so bold. These may represent a cline toward the next subspecies.

Charaxes numenes neumanni Rothschild

(Pl. 9, figs 67, 68, Map 6)

Charaxes numenes neumanni Rothschild, 1902 : 597.

MALE. Fore wing length 45 mm. The characters given for the race are: marginal spots of both wings larger than in West African *numenes*; admarginal spots of hind wings also enlarged, confluent, yellow; white submarginal dots smaller than in *numenes*; discal spots a little more proximal. Underside, ground colour is more brownish, less olive drab, the darker bands on both wings dark brown, the white outlining very narrow.

Described from a single male, this subspecies has now been recorded from Ethiopia by Ungemache at Youbdo; Hodson obtained it from the Ganji River and Haeto; Malcome Berkeley took it at Adola in south Ethiopia.

SYSTEMATIC LIST

Charaxes fuscus Plantrou

Charaxes fuscus Plantrou, 1967. Type locality: Bangui, Central African Republic.
Range: Only known from the locality of the unique type.

C. numenes Hewitson

Charaxes numenes (Hewitson), 1865. Types male and female. Type locality: Sierra Leone.
Range: Occidental Africa: Sierra Leone, Liberia, Ivory Coast, Ghana, western Nigeria, Fernando Po.

Charaxes numenes intermediate cline.
Synonym: var. *laticatena* Le Cerf, 1932. Congo.
Range: Cameroun, Central African Republic, Gabon, Congo (Brazzaville), N. Angola, Kasai, Katanga.

Charaxes numenes aequatorialis ssp. n.
Synonym: var. *obsolescens* Stoneham, 1931. Malawa, Kenya.
Range: The eastern Congo from Semliki Valley to N.W. Kenya, including western Uganda to TransNzoia in Kenya; the area around Lake Victoria to eastern shores of Lake Tanganyika, in the north.

Charaxes numenes aequatorialis ssp. Small aggregate.
Range: Mt. Moroto, Turkana; Mt. Marsabit, Kenya.

Charaxes numenes neumanni Rothschild, 1902. Type male. Type locality: Wori-Gamitscha; Kaffa, Ethiopia.
Range: West and south Ethiopia.

8. *CHARAXES BIPUNCTATUS* Rothschild and its Subspecies

Charaxes bipunctatus Rothschild

(Pl. 9, figs 69–72, Map 7)

Charaxes bipunctatus bipunctatus Rothschild, 1894 : 536.
Charaxes bipunctatus johnsoni Rousseau-Decelle, 1956.

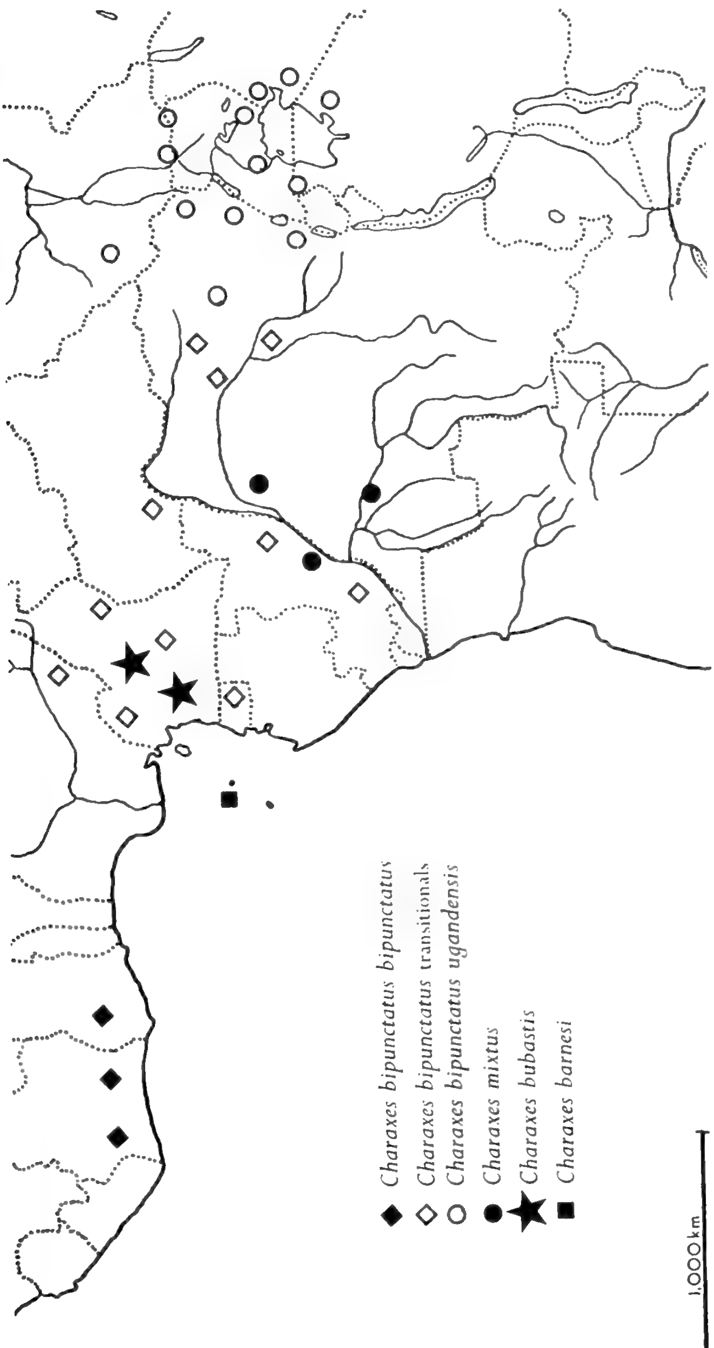
The type locality given by Rothschild, 1894, was 'West Africa, ? Gold Coast'; this was subsequently restricted by Butler (1896) to Accra, Gold Coast. In 1956 Rousseau-Decelle described the race *johnsoni*, also from the Gold Coast, apparently thinking that specimens from further east, possibly Uganda, were nominotypical. In actual fact, the species *bipunctatus* is separable into two geographical races, with an intermediate cline between them.

Nominate specimens from the Ivory Coast and Ghana are smaller than Uganda examples, and differ in other ways.

Male. Fore wing length 43–44 mm. *Upperside.* Fore wing, ground colour blue-black. Blue spots in median or discal line variable, usually two streaks beyond the end of the cell, a slightly larger spot sub-basal in 3, a smaller spot in 2, not always visible. Subcostal spot in postdiscal line white, occasionally a blue spot below, and traces of spots in 2 and 3. Marginal ochreous lunules small, well separated by black ground. Hind wing ground colour blue-black, duller on inner fold, edge greyish, with slightly paler ochre tinge above anal angle. A subcostal blue spot at about mid point in the discal line; postdiscal spots, two upper ones large, and may be followed by a trace of smaller spots in spaces below. Submarginal blue spots with white central dot complete, and double in the anal angle; marginal golden ochreous lunules narrow; edge black, slightly dentate, tails very stumpy. *Underside.* Fore wing, ground colour olivaceous drab at base, more olive greyish on the borders of wing. Cell with three wavy black lines, the central mark often divided, all white edged; the sub-bases of 1b and 2 with larger black bars; the discal bar ochreous grey with a series of curved black lines on the proximal side; the submargin of the wing with rather obscure ocelli with darker centres more pronounced in 1b and 2 where the centres are black, the marks outlined distally with bluish grey, the margin with rather obscure ochreous lunules most pronounced at hind margin. Hind wing, ground colour as fore, the base with wavy narrow black lines outlined white proximally, those of the discal line whitish distally, followed by obscure, slightly ochreous lunules with greyish and black proximally; submargin with small white dots, double at anal angle, which is distally shaded in black. Marginal border narrowly ochreous, edge black, more olivaceous at anal angle.

Female. Fore wing length 45 mm. *Upperside.* Fore wing, base olivaceous brownish, shading to black in upper part of cell and proximal side of white bar, which crosses the wing from the costa to just short of the hind angle, where the spots are smaller and ochre-tinged. Distal portion of wing black with two white spots in subapex, occasionally a trace of a spot in 4 below. Margin of wing with two ochreous spots at hind angle. Hind wing, ground colour lighter brownish olive; a whitish spot is present on subcosta at upper discal line, paler olive-ochre spots in upper part of postdiscal line becoming more obscure in lower half bordering on the black border, which is widest at upper angle and tapers toward the anal angle; submargin with a series of stellate white spots; margin with pale ochreous linules; edge black, slightly dentate, tails short and stumpy. *Underside.* Fore wing, ground colour and pattern as in the male but with the white bar, similar to above, but proximally outlined in black. Tornal marks black, but the rest of the ocelli above obscure. The two white sub-apical spots distinct. Hind wing more or less as in the male, but anal ocellus more distinct.

Range: Nominate *bipunctatus* appears to be limited to the Ivory Coast and Ghana. I cannot trace any records from western Nigeria.


Charaxes bipunctatus bipunctatus
Charaxes bipunctatus transitionals
Charaxes bipunctatus ugandensis
Charaxes mixtus
Charaxes bubastis
Charaxes barnesi
1,000 km

MAP 7.

Charaxes bipunctatus cline

(Map 7)

It is unfortunate that Rothschild gives such a wide distribution for the species in his monograph of the *Charaxes* (1900 : 390), and still puts the type-locality as 'West Africa, ? Gold Coast', though accepting the specimens from Accra and Ashanti as nominotypical. Specimens from Cameroun and the Central African Republic, Gabon and possibly Moyen Congo appear to be intermediate in character between the nominate *bipunctatus* and those from Uganda and N.W. Kenya. It will be noted that the above description given by Rothschild is somewhat different from that of the original description (1894 : 536–537) based on the type. One can only assume that the latter was based on the augmented series then at Tring, which I suggest was a composite one.

Male. Intermediate in size between the nominate race and that found in Uganda. Fore wing length 45 mm. *Upperside.* Fore wing, the blue spots in the median line are very obscure, sometimes almost absent; the subapical spot small; the marginal golden lunules stronger than in nominate. Hind wing, blue spots at upper angle strong or obscure; the submarginal small blue spots very faint and most marked at the upper angle; the marginal golden lunules strong. The characters of this cline thus embody those of the nominate and the Uganda race.

Range: Cameroun, Central African Republic, Gabon, Moyen Congo and perhaps the Mid-Congo River region.

Charaxes bipunctatus ugandensis ssp. n.

(Pl. 10, figs 73–75, Map 7)

Male. Fore wing length 49–50 mm. *Upperside.* Fore wing, ground colour more purplish brown-black, with slight greenish sheen at base of wing. Discal or median line of blue spots usually small and limited to two, the uppermost beyond the cell usually absent, spots deeper blue, the spot in 3 is rarely present. Subapical spots, upper one large, distinct and white, the second spot small and obscured. Marginal golden lunules bold. Hind wing, ground colour as fore wing shading to brownish on the inner fold; subcostal blue spot in the discal line usually absent, but the upper spots in the discal line, one above the other, darker blue; very rarely a third spot. Submarginal spots blue or blue with white centres, strong in upper angle but tailing off towards the hind angle where the spots may be small and whitish; marginal golden lunules strong and bold, very narrowly separated by black; edge black with ochreous fringe enhancing width of golden line; margin bluntly dentate, tails very stumpy. *Underside.* Ground colour browner; pattern similar but bolder except on the distal border where it is more obscured.

Female. Fore wing length 50–54 mm, general colour and pattern similar to nominate female, but differing as follows: *Upperside.* Fore wing, the basal ground colour brownish olive, the amount of black shading toward the cell and proximal side of white bar less than in the nominate race; bar similarly formed but third upper spot at base of 4 usually smaller and the marks more separated, those towards the hind angle more tinged with ochreous; the golden ochreous marginal spots larger and more distinct. Distal half of wing black, the two sub-apical spots larger, and there may be traces of spots, more ochreous in colour, in 4 and 5. Hind wing, ground colour as fore wing; a paler subcostal spot in discal line, then two light spots in upper postdiscal line with less conspicuous marks in spaces below; border of wing blackish, widest at upper angle where it may extend and encroach on costa, at lower end it tapers towards the anal angle; border with small whitish dots more in evidence at upper angle but less clear than in western

examples; border with wider golden ochreous marginal band, spot at upper angle more conspicuous and rounded, the marks forming the band only narrowly separated by black veins; edge black with narrow ochreous fringe. Edge bluntly dentate, tails very stumpy. *Underside.* Fore wing, ground colour very like nominate race, slightly more brownish tinged, but the dark band through the disc stronger; wavy black bars in cell similar, but black marks sub-basal in 1b–2 and proximal to the white bar larger; pattern on distal portion of the wing very similar. Hind wing ground colour as in nominate race, so also the general pattern, but less strong; black edge to postdiscal lunules less marked; submarginal whitish spots less in evidence, but these differences are slight.

Holotype male. UGANDA: Toro For. (J,), x.1949 (*van Someren*).

Allotype female. UGANDA: Toro, Kibali Forest, v–vi.1956 (*van Someren*).

Within this general area, that is, in the Madi area of northern Uganda and neighbouring southern Sudan, we find a smaller aggregate, ♂ 45 mm, ♀ 47 mm. The males have a stronger greenish sheen at the base of the fore wing. The discal blue spots at the end of the cell more distinct; the subapical spot strong; golden borders of both wings strong. The females have slightly darker brown colour to base of fore wing and hind wing. The fore wing bar strongly tinged with ochreous. On the underside, the females exhibit a stronger pattern, the black marks sub-basal in 2 and 3 conjoined forming an almost solid black patch. This is probably merely an aberration.

Range: Uganda and North-west Kenya, extending westward into the Semliki Valley and eastern Congo. The smaller aggregate is found in West Madi on the Metu Hills; and adjoining Southern Sudan.

Types in B.M.N.H.

SYSTEMATIC LIST

Charaxes bipunctatus Rothschild

Charaxes bipunctatus bipunctatus Rothschild, 1894. Type locality: Gold Coast.
Synonym. *Charaxes bipunctatus johnsoni* Rousseau-Decelle, 1956. Type locality: Gold Coast.
Range: Limited to occidental Africa: Ivory Coast and Ghana, ? western Nigeria.

Charaxes bipunctatus intermediate cline to *ugandensis*.
Range: Cameroun, Central African Republic, Gabon, Congo (Brazzaville) and perhaps the mid Congo River region.

Charaxes bipunctatus ugandensis ssp. n.
Range: Uganda and north-west Kenya, extending westward into Semliki Valley and eastern Congo. A smaller aggregate is found in West Madi on the Metu Hills and adjoining southern Sudan.

9. THE PROBLEM OF ***CHARAXES MIXTUS*** ROTHSCHILD, ***CHARAXES BUBASTIS*** SCHULTZE, AND RELATED SPECIES

The males of both these species resemble somewhat the male of the *Charaxes tiridates* association, i.e. *tiridates*, *bipunctatus*, *numenes*, etc., whose females also

bear a resemblance to each other, having a brownish olive colour to the bases of fore and hind wing and having a conspicuous oblique white bar in the fore wings. The females of the *mixtus* group, on the other hand, are somewhat male-like, but duller and more brownish.

It is of interest to note that at one time male *mixtus* was considered to be a variation of *tiridates*, and that *bubastis* was a hybrid between *mixtus* and *smaragdalis*!

The male type of *Charaxes mixtus* came from Lokolele in the mid-Congo region; the type of male *bubastis* is from Bipindi in the Cameroun and there is a second example from the Njong River, also in Cameroun.

In 1898 Rothschild described and figured what he took to be the female of *Ch. mixtus*. This specimen came from the Cameroun. It is totally different from any of the females of the *tiridates* association, and can be roughly described as having the appearance of a larger, duller, more brownish black form of the male. Later on, another female was taken at Kafakumba, Katanga, S. Congo. The association of these females with male *mixtus* has been generally accepted, but it has not been verified by breeding, nor by taking a pair 'in cop', so far as I can ascertain.

Male *mixtus* is now well represented by specimens taken in the area from the Central African Republic, W. Congo, Kasai and Katanga. The female is still very rare, but two specimens have been kindly loaned to me, the type from the Berlin Museum, the other from the Congo Museum, Tervuren. They agree in all respects.

Charaxes mixtus Rothschild

(Pl. 10, figs 76–79, Map 7)

Charaxes mixtus Rothschild, 1894 : 554, t. 12, fig. 8.
Charaxes mixtus Rothschild, 1898 : VI. Female, type locality: Cameroun.

Male. Fore wing length 48–50 mm. *Upperside*. Fore wing, ground colour blue-black, duller black at the base. Discal or median row of blue spots rather variable in number, sometimes three, sometimes four to five in a curve; the upper mark may be a mere blue streak in the subcosta, followed by a larger spot at the end of the cell and more conspicuous spots in 3–2 and the trace of a spot in the upper part of 1b. The postdiscal row of spots consists of two well-marked white spots in subapex, followed by a trace of spots, blue in colour, in spaces below, the marks in 1b and especially that in 1a, bolder. The margin of the wing with whitish marks double in 1b, strong in 2, then more diffuse in spaces up to the apex. Hind wing, ground colour blue-black, duller on the inner fold which is smoky grey-black. On the postdiscal line there are conspicuous blue spots in a row from subcosta to above the anal angle, the spot in 6 set in so that the line is here kinked or angled proximad. The submargin has a row of bluish white spots or stronger blue with white centres. Admargin with a series of bluish white lunules, sometimes white at upper angle; edge with whitish internervular fringe; margin slightly dentate. Tails thin and pointed, 5–3 mm long. *Underside*. Both wings drab olive-grey, slightly darker in disc of fore wing. Fore wing, cell and sub-bases 1b–2 crossed by black lines slightly edged with white; discal line of paler angles outlined proximally in black not very strong; postdiscal series of obscure ocelli become strongly marked at tornus and space above; subapical spots whitish; margin with olive-ochreous lunules. Hind wing with thin black marks in sub-base; disc with paler spots finely edged with black proximally, followed by a postdiscal series, kinked at 5, extending from 6 to anal angle and crossing the inner fold; submarginal series of whitish spots, blackish distally, lie in contact with the admarginal series of olive-ochre lunules; margin brownish black with paler fringe.

FEMALE. Fore wing length 54–56 mm, thus larger than the male. *Upperside*. Ground colour of both wings rather browner especially at the bases. Fore wing, median blue spots larger but duller, that at end of cell obscured. Postdiscal spots obscured, except the two at the hind angle which are dull bluish while the two subapical are clear and white, the upper one somewhat linear. Marginal spots rather obscured, slightly ochreous in colour, double in 1b. Hind wing, pattern of blue spots as in the male, but postdiscal spots almost obscured except for that in 6 but even this is dull. Submarginal bluish spots complete but dull; marginal lunules well developed but dull olive-ochreous. Tails, rather thin and pointed, upper 7 mm, lower 4 mm. *Underside*. Fore wing, ground colour brownish olive, paler at the base and with a darker zone in the discal area; black wavy lines cross the cell, that at end of cell adjacent to the series of black lunules distally shaded with greyish, in the median line; the postdiscal series of strongly ochreous spots in 1b and 2 become increasingly obscure but more whitish in the subapex; the tornal black marks, double in 1b are strong. Margin with ochreous marks decreasing in size from 1b to apex. Hind wing, ground colour as in fore wing; basal black lines thin but distinct corresponding to those in the male. The postdiscal series of paler spots in the form of lunules, complete but weak, that at anal angle stronger. Submarginal spots complete, dull, sometimes with black dot distally, double at anal angle on olive ground. Admargin with ochreous lunules, edge darker brownish.

Variation: The amount of variation in the male is not, as a rule, very great as can be seen from the figures on Plate 10, with the exception of fig. 77, which depicts a specimen with large and extended blue spots in the postdiscal zone of the hind wing. On the other hand the blue spots on the upperside of the type (Pl. 10, fig. 76) especially in the hind wing, are obscured.

There is nothing on record regarding food plant or early stages.

Range: Katanga, S. Congo; W. Congo; Central African Republic; Cameroun.

Charaxes bubastis Schultze

(Pl. 10, fig. 80, Map 7)

Charaxes bubastis Schultze, 1917 : 110, t. 13.

As indicated in the introductory note, there has been some speculation as to the correct status of this *Charaxes*. The suggestion that it is a hybrid can be discounted for such are extremely rare in nature. Moreover, the insect is known from at least four specimens taken in different localities, at different times.

I have before me two specimens, one compared with the type and another perfect example; they agree in all respects.

MALE. Fore wing length 51–52 mm. *Upperside*. Fore wing, ground colour blue-black with a slight purplish tinge, more brownish at the base. Median or discal row of blue spots larger than in *mixtus*, more purplish blue, consisting of a streak beyond the end of the cell, followed by a smaller more rounded spot sub-base in 3, followed by a larger spot directly below in 2, the double spots in 1b (vestigial in one specimen). In the postdiscal row, the subapical spots are bold and white, while the lower spots are obscured, though more apparent in 1b and 1a. Margin with well marked ochreous spots well separated by dark ground, double in 1b, and extending up to the apex; these spots more defined than in *mixtus*. Hind wing, ground colour purplish blue-black shading to more greyish on the inner fold. Disc of wing in one specimen with a slight greenish bloom; there is also a subcostal blue spot. Postdiscal row of spots may be complete or lacking the upper spot in subcosta, the remainder blue with slight purplish tinge,

the upper three spots less angled than in *mixtus* and nearer the submarginal row of whitish blue spots, which in turn are less approximated to the marginal row of blue lunules, which are whitish at the upper angle; edge slightly serrate; tails more robust and shorter, 4–3 mm long. *Underside.* Fore wing, ground colour olive-drab, more olive-ochreous at basal angle, discal area rather darker. Cell crossed by the usual black lines, narrowly outlined in white; a median series of light lunules accentuated in black proximally present; stronger black lines sub-basad in 1b and 2. Submarginal ocelli with black centres present in 1b and 2, the rest tending to fade out; subapical white spots strong; margin with olive-ochre spots not as defined as on upper side. Hind wing, ground colour as fore wing; very thin black in basal area; discal and postdiscal paler spots distinct, those in the lower portion of the line with dark shading distally; submarginal row of spots as above but not so defined; marginal lunules greyish buff; edge brown not sharply serrate but more dentate. Anal angle golden olive with double black dots.

The FEMALE is not known.

Thus there is some general resemblance to *Charaxes mixtus*; but since the differences between the two are obvious, I consider *bubastis* a distinct species.

Range: Known only from Cameroun, specimens having been taken at Bipindi (type-locality) and at the Njong River.

Charaxes albimaculatus sp. n.

(Pl. 11, figs 81, 82)

Amongst the material of '*mixtus*' kindly loaned to me by the British Museum (Nat. Hist.) is a male specimen which had been tentatively placed as a variation of *mixtus* Rothschild. It, however, exhibits some outstanding characters which suggest that it belongs to a distinct undescribed species. This specimen was taken at Stanleyville in northern Congo.

Until recently no female could be associated with this unique male but, as a result of exchange of photographs and specimens with Monsieur Plantrou of Paris, it now appears that he has in his collection a female which belongs to this species. The specimen was obtained at the recent sale of the Le Moult collection in Paris. This insect has now been forwarded to me, and it is without doubt a female of the male I am now describing. It possesses all the essential characters of the male, including the conspicuous submarginal white spots in the hind wing above and the almost uniform colour of the hind wing below, thus differing considerably from the female of *mixtus*, to which it had been placed.

MALE. It is considerably smaller in size than *mixtus* Rothschild, fore wing length 42 mm; the hind wings more pyriform due to the more pointed anal angle; the antennae are shorter. *Upperside.* Forewing, ground colour is a deep blue-black, slightly duller blackish at the base. The blue spots in the median and postdiscal line are small and punctiform, the two upper spots in the median line larger than the rest; the ochreous spots on the margin are smaller but more distinct. The hind wing is blue-black, shading to brownish on the inner fold, immaculate in the disc and postdiscal area, but the submargin carries a row of conspicuous white spots, double at anal angle; this character is outstanding. There is *no* marginal border, the wing being black to the edge which is bluntly serrate. *Underside.* Fore wing, strongly patterned, the ground colour a warm olive brownish, paler, more ochreous at the base where the black lines and spots are bold, that crossing the end of the cell continuous with the black marks in sub-bases of 1b and 2. The mid zone of the wing is obliquely crossed by black lines distally shaded in ochreous

to whitish, terminating in a large black mark in 1b, which is contiguous with the darker zone separating the oblique bar from the rather obscure ocelli of the postdiscal line, the subcostal subapical mark whitish; the ocelli in 1b and 2 with black centres; margin with ill-defined ochreous lunules, double at tornus. Hind wing, ground colour almost uniform brownish olive with one faint subcostal spot in median line; black line in sub-base very thin, median area and postdiscal zone without marks, but submargin with white spots as upperside; margin slightly darker especially in mid area, but there is no marginal border. Anal angle with lilac and double black dots.

FEMALE. Fore wing length 54 mm. *Upperside.* Fore wing, ground colour purplish brownish black at base of wing but darker in distal half; purplish blue spots in the discal line from end of cell to 1b where the marks are faint; two white spots in the subapex, the upper one rectangular, the lower smaller and rounded; margin with faintly indicated ochre-greyish spots; edge faintly whitish. Hind wing, basal area as fore wing, shading to greyish brown on the inner fold; distal portion of wing darker brownish black with indication of three paler purplish brown spots in postdiscal line in 6–7, these spots placed more toward the series of conspicuous white submarginal, somewhat angled, spots placed as in the male. There are no marginal lunules; extreme edge faintly whitish. Tails short, 4 and 3 mm. *Underside.* Similar in all respects to that of the male.

Holotype male. N. CONGO: Stanleyville, iii.1924 (Ertl collection, ex Joicey Bequest, B.M.(N.H.).

Allotype female. S. CONGO: Katanga, Kafakumba (Overlaet Collection, ex Le Moult) in Coll. Plantrou, Paris.

Charaxes barnesi Joicey & Talbot
(Pl. 11, figs 83, 84)

Charaxes barnesi Joicey & Talbot, 1927 : 14.

No actual specimens are available to me for description but, through the kindness of the British Museum (Nat. Hist.), photographs of the types are here reproduced. For the brief description I have had to draw on the original one given in the publication cited above.

MALE. Fore wing length 48 mm. *Upperside.* Ground colour of both wings deep blue, more intense over the proximal half of both wings. Fore wing, the median row of blue spots consists of three streaks in subcostal area in 4–6, followed by more quadrate marks set out a little in 3–2, followed by a smaller spot in upper part of 1b approximating toward the postdiscal spot in the same area; post discal spots complete, commencing with two large white spots in subapex, followed by blue marks of increasing size and extending to the hind margin where the mark is a streak. Margin with white linear marks, double in 1b, decreasing in size up to apex. Hind wing, disc immaculate, but postdiscal zone with a series of large blue spots from subcosta to above anal angle, the spot in 6 set in so that the line is here kinked, the spots in 3 set in a little so that the line has a double curve; submargin with a row of blue-white centre spots; marginal border with whitish lunules; edge black, very slightly dentate, tails comparatively short and thick, upper 5 mm, lower 2 mm. *Underside.* Fore wing, ground colour olive-drab; black bars narrowly outlined in white in the cell; thicker black bars sub-basal in 1b–2, these marks set in more basad than usual. Disc of wing crossed by a paler zone in the median line, corresponding to the blue of upperside, but extending to and tapering in 1b. Two white subapical spots prominent; postdiscal area with paler lunules forming the inner side of the row of obscure ocelli with darker centres, more distinct in 1b where the centre is black. Hind

wing, ground colour as fore wing; base with small light marks outlined in black; discal zone with thin black line shaded whitish distally, crossing the inner fold; postdiscal row of light yellowish marks corresponding to blue marks above; submarginal series of whitish spots double at anal angle, clear; marginal border pale ochre.

FEMALE. *Upperside.* Joicey and Talbot compare this with *Ch. cithaeron* as having the same purplish brown ground colour. The white band of the fore wing commencing at the subcosta as a streak, widens to 2, then abruptly narrows in 1b, the double spots being set towards the end of the mark above. The margin has two pale spots in 1b. Hind wing with the discal border blackish, defined on the inner border by a series of purplish blue spots, large and distinct at subcosta and decreasing in size and distinctness to above anal angle. There is a large well defined bluish spot in the subcosta at upper median line. A complete row of blue white-centred present in the submargin; the margin with distinct lunules, white at upper angle, then shaded with purplish toward anal angle. Tails thick, relatively short, upper 6 mm, lower 3 mm. *Underside.* Fore wing, ground colour as in the male; the white bar formed exactly as above; the two subapical white spots strongly represented; the obscure submarginal ocelli as in the male; margin without any pale marks. Hind wing, ground colour as in the male, the pale mark at subcosta in the discal line followed by a zigzag series of less strong marks to above anal angle where the spot on inner edge of fold is whitish; postdiscal series of paler spots arranged in same way as marks above; submarginal row of whitish spots, double at anal angle fairly distinct; marginal lunules whitish at upper angle are shaded with purplish in region of tails and anal angle.

Range: Known only from the island of Principe in Gulf of Guinea.

SYSTEMATIC LIST

Charaxes mixtus Rothschild

Charaxes mixtus Rothschild, 1894. Type locality: Lokolele, mid Congo River (♂), Cameroun (♀).
Range: S. Congo, Katanga, W. Congo, Central African Republic (Moyen Congo), Cameroun.

Charaxes bubastis Schultze

Charaxes bubastis Schultze, 1917. Type locality: Bipindi, Cameroun.
Range: Only recorded from Cameroun at Bipindi and Nijong River.

Charaxes albimaculatus sp. n.

Charaxes albimaculatus sp. n. Type locality: N. Congo, Stanleyville (♂), S. Congo, Kafakumba, Katanga.
Range: N. and S. Congo.

Charaxes barnesi Joicey & Talbot

Charaxes barnesi Joicey & Talbot, 1927. Type locality: Principe I.
Range: Confined to Principe Island in the Gulf of Guinea.

10. Further notes on *CHARAXES MANICA* Trimen and *C. MCCLEERYI* sp. n.

Charaxes manica Trimen

After my previous notes on this species (1966 : 86) had gone to press, Monsieur Jacques Plantrou of Paris received, during the latter part of 1966, some interesting specimens of a 'Black' *Charaxes* of the '*Etheocles*' Complex taken in the Brazzaville area of the Congo by Monsieur Auberger. Monsieur Plantrou rightly placed them to the species *manica*, but noted that they differed considerably from the nominate race. The specimens were in due course submitted to me for an opinion. There is no doubt that they represent a good subspecies from an area in which *manica* has not hitherto been recorded.

Charaxes manica subrubidus ssp. n.

(Pls 11, 12, figs 85–92)

Male. Fore wing length 36 mm. *Upperside.* Fore wing, shape and ground colour similar to the nominate race. The subapical spots slightly larger and whiter, the blue spots beyond the end of the cell more obscured, that at upper part of end of cell barely indicated. Hind wing submarginal bluish spots as in nominate race, but the marginal border slightly broader and brighter red above upper tail but mixed with golden olive from lower tail to anal angle; edge black with trace of a fine white fringe. Tails as in the nominate race. *Underside.* Fore wing, ground colour and pattern as in nominate but slightly more rufous at base; the postdiscal lunules larger, more distinct and reddish. Hind wing, ground colour more reddish toward base; pattern similar, but postdiscal lunules strongly reddish and mixed with orange at the anal angle. Marginal border wider and brighter red to upper tail, then mixed with orange to anal angle.

Holotype male. Congo: Brazzaville, October 1966 (coll. J. Plantrou).

The female forms taken so far are also distinctive, though some of them have their counterpart in the females of *manica manica*.

♀ form *atribasis* forma n.

(Pl. 11, figs 87, 88)

Fore wing length 40 mm. Upperside, nearest to the form *manica* of the nominate race but differing as follows: Fore wing, base blackish, or blue-black in side light as far as the upper part of the white oblique bar, the pale blue being limited to the lower proximal half of the bar in 1a–1b and very slightly in 2. The white bar is widest at the costa where there is an extension into the sub-bases of 6–7, the bar tapering slightly to 2, then represented in 1b by a smaller spot in upper part and a few white scales in the lower which is mainly blue; the distal half of the wing is black; the subapical whitish spots large; edge of wing with very narrow white inter-neural fringe. Hind wing, basal area black with bluish bloom in side light, shading to more greyish on the inner fold; disc of wing with a broad pale blue discal patch, commencing at the costa and widening in 5–4, then tapering to above anal angle; border of wing black, widest at the upper angle with a complete row of rather conspicuous lilac spots with white centres in the

submargin. Marginal border brick-red above upper tail then mixed with olive toward the hind angle; and edge black; tails fairly long and thin, 6 and 5 mm long. *Underside.* Fore wing, rather paler than in nominate, the satiny greyish brown area in subapex more distinct. The extension of the white bar along the subcosta more strongly marked than above; the black tornal marks and the black marks on proximal side of white area in 1b, strong. Hind wing, ground colour not so dark, but the postdiscal row of reddish lunules conspicuous as are the white lunules in the submarginal line, those toward the anal angle distally accentuated with black.

Holotype female. Congo: Brazzaville, 19. x.1966 (coll. J. Plantrou).

♀ form ***aubergeri*** **forma n.**

(Pl. 12, figs 89, 90)

Fore wing length 40 mm. *Upperside.* Fore wing, pattern corresponding more or less to the form *chintechi* of the nominate race, the orange spots of the discal and postdiscal row bolder, with an extension into the cell at 4, but these spots are on a greenish black ground, those of the discal line suffused over with a beautiful iridescent greenish blue which replaces the white of the nominate form, and extending basad onto the black base of the wing. Margin of wing with obscure ochreous spots, white and double in 1b. Hind wing, discal and postdiscal area with a large patch of iridescent bluish green, slightly paler in the disc and slightly shaded orange toward the costa where there is a distinct blackish oval mark; the base of the wing dark but with a blue sheen. Border of wing strongly black, carrying a complete row of conspicuous bluish white linear marks; margin with reddish lunules outlined in white mixed with olive toward the anal angle. Tails long, thin, upper 6 mm, lower 5 mm. *Underside.* Fore wing, ground colour strongly rufous, the discal and postdiscal spots on upperside are here dull orange, the marks in 1b coalescent; tornal black mark strong, with two whitish dots distally on margin. Hind wing, ground colour rufous brown with a paler disco-postdiscal bar crossing the wing accentuated proximally by a fine black line and distally by more reddish contiguous lunules in the postdiscal line. Submarginal white linear marks strong; marginal red border rather narrow outlined greyish proximally shading to olive at anal angle.

Holotype female. Congo: Brazzaville, 25.v.1967 (coll. J. Plantrou).

This distinct form is name after its discoverer.

♀ form ***pseudosmaragdalis*** van Someren & Jackson **comb. n.**

(Pl. 12, figs 91, 92)

Charaxes cedreatis vetula, ♀ f. *pseudosmaragdalis* van Someren & Jackson, 1957 : 89.
Charaxes cedreatis, ♀ f. *pseudosmaragdalis* van Someren & Jackson; van Someren, 1969 : 89, pl. 3, figs 18, 19 (type).

This distinctive form was erroneously assigned to *Charaxes cedreatis*, largely on account of its very conspicuous submarginal linear marks above and below on the hind wing. Moreover, *Ch. manica* had not been recorded further west than Katanga. I am glad to have the opportunity of correcting the error.

Fore wing length 40 mm. *Upperside.* Fore wing, ground colour, distal portion black, basal area black at end of cell, but strongly suffused with greenish blue to the base, as in the other females described. The wing is crossed by two rows of spots, discal and postdiscal, exactly as in f. *aubergeri*, the marks coalescing at the hind margin; the discal spots are bright

blue, as are the postdiscal, except for the two subapical ones which are white. The margin of the wing has a series of obscure pale spots as in *aubergeri*. Hind wing, basal area is blackish with the same strong greenish blue iridescence in side light; the inner fold is greyish. The disc of the wing has a large iridescent blue patch as in the other forms, the outer border sharply defined from the black border, which carries distinct bluish white linear marks, double at the anal angle; the marginal border is reddish above the upper tail, outlined in whitish and mixed with olive at the anal angle. Tails as in other forms. *Underside*. Fore wing, ground colour of one of the specimens taken at Brazzaville is more rufous than that of the type, but the satiny bars and the black marks at the hind angle are similar. The same remarks apply in regard to the hind wing, but unfortunately the distal portions of both hind wings are missing in the Brazzaville specimen submitted.

Range: So far as is known, this new form of *manica* occurs in the region of Brazzaville and Leopoldville, and greatly extends the range of the species to the west.

Note by Monsieur Jacques Plantrou.

'This form seems to be especially rare, and there is too little material to form an idea as to the relative proportions of the various female forms. As far as we know, only two males, three female *atribasis*, two *aubergeri* and three *pseudosmaragdalis* have been taken in spite of intensive trapping by at least three collectors during a period of three years.'

***Charaxes mccleeryi* sp. n.**

(Pl. 12, figs 93, 94)

Charaxes sp. n.? van Someren, 1969 : 163, No. 26.

This species belongs to that highly complex association which includes *manica*, *alpinus*, *etheocles*, *ethalion*, etc., whose males are often confusingly alike and whose females are very variable. After a thorough examination of its genitalia along with those of allied species, one is forced to regard *mccleeryi* as a distinct species. Moreover its distribution coincides and is overlapped by others of the group. For comparative illustrations of genitalia, *vide* van Someren, 1969 : 163, No. 26.

MALE. Including the type, fore wing length 34–36 mm; apex bluntly pointed; outer margin slightly incised. *Upperside*. Fore wing, black, with very slight greenish tinge at base, immaculate, except for two faint blue spots in the sub-apex, sometimes only one. Extreme edge of wing with very narrow white fringe in interspaces. Hind wing, black, slightly duller on inner fold; minute white dots on submargin, in region of tails, and double mauvish spot in anal angle; border of wing maroon above tails, shading to olive-green from upper tail to anal angle. Margin of wing very slightly serrate, tails at veins 4 and 2, 5 and 6 mm long, thin, black in colour with olive centre line. *Underside*. Fore wing, ground colour warm greyish brown with ferruginous bloom; satiny bars in disco-postdiscal line divided at costa by a dark quadrate mark. Three ovoid black spots in fore wing cell narrowly outlined in white, fine black lines beyond, those in sub-bases 6–2 in discal line, black. Submarginal zone with obscured dark spots, but double and very distinct in 1b at the hind angle, the black spots shaded with greyish proximally and outlined in black distally. Hind wing, ground colour as fore wing, the dark discal bar edged in black; postdiscal zone with maroon lunules edged with olive proximally and lined in black, the olive more apparent above the anal angle. Margin of wing maroon to upper tail, then olive, edge proximally in black, double spot in anal angle; edge black with narrow white fringe. There is a pale mark on the inner fold above the anal angle.

FEMALE. Those captured to date bear a strong resemblance to the white-barred form of *etheocles* but with smaller discal-postdiscal white spots in fore wing. Fore wing length 42 mm. *Upperside*. Fore wing, shape similar to the male but outer margin less incised. Ground colour brownish black, with slight greenish tinge at base. Spots in discal line as follows: two subcostal spots in sub-bases 6–5, upper larger, followed by spots in sub-base 3 and base of 4, the latter small and set in towards the end of the cell, the spot in 2 quadrate, than in 1b larger, with incised inner edge, that in 1a an elongate streak, the upper spots off-white, the lower white. The postdiscal row of spots are smaller and well separated, three in a row in sub-apex, spot in 4 set in, followed by an angular mark in 3 and a faint mark in 2. The two rows of spots are well separated. Hind wing, ground colour black in basal area and border, greyer on the inner fold. The disc of the wing with a white bar, 6 mm wide at costa then tapering but lower borders strongly bluish, especially on the proximal side. Border of wing with mauve lunules with white centres, ending in a double mauve spot in the anal angle; margin with a maroon line shading to olive and expanding at anal angle. Tails long and thin, upper 7 mm, lower 8 mm. *Underside*. Fore wing, ground colour earthy brownish grey with rufous bloom; darker bar in the discal–postdiscal zone separating the two rows of whitish spots, those in the outer row buffish, both arranged as upperside. Border of wing with hardly any indication of dark sub-marginal spots except in 1b, where the double black spots are large, conspicuous and bordered with whitish, forming a strong 'eye-spot'. Hind wing ground colour as fore; basal dark lines faint; discal white bar narrower than above and extending to just beyond the end of the cell. Postdiscal maroon lunules, edged olive and black proximally, fairly distinct, shading to olive above anal angle, with a pale buffish mark on inner fold just above. Marginal white lunules very distinct, bordered by equally distinct reddish lunules to upper tail then shading to olive at anal angle, with some black between the rows, especially in the region of the tails, ending in the double black spot in the anal angle.

Some females are more flushed with rufous over the entire underside.

Holotype male. TANZANIA: Bunduki Hill, Uluguru Mts, 6000 feet. vii.1966 (*C. H. McCleery*). To be deposited in the British Museum (Nat. Hist.).

Allotype female. Same data.

Paratype males (2), Uluguru Mts, February 1967 (*J. Kleilland*).

Range: At present known only from the Uluguru Mts in Tanzania.

SYSTEMATIC LIST

Charaxes manica Trimen

Charaxes manica subrubidus ssp. n. Type locality: Congo, Brazzaville.
Range: Congo, Brazzaville, Leopoldville.

Charaxes manica subrubidus ♀ f. *atribasis* forma n. Type locality: Congo, Brazzaville.

Charaxes manica subrubidus ♀ f. *aubergeri* forma n. Type locality: Congo, Brazzaville.

Charaxes manica subrubidus ♀ f. *pseudosmaragdalis* van Someren & Jackson 1957, **comb. n.** Type locality: Congo, Leopoldville.

Charaxes mccleeryi sp. n.

Charaxes mccleeryi sp. n. Type-locality: Tanzania, Uluguru Mts.
Range: Only known from the type locality.

II. Further notes on the *CHARAXES XIPHARES* Complex and a Description of a New Subspecies

Charaxes xiphares woodi van Someren

Charaxas xiphares woodi van Someren, 1964 : 195.

When I described this subspecies of *Charaxes xiphares*, it was known from only two males. Intensive search has been made for the female in the two localities from whence the males were taken, but it was not until April 1966 that an almost perfect female was secured by Mr Peter Martin on Soche Mt., 5000 feet, Malawi, in almost the same spot where he had taken a male earlier in the same month. He took a second female at the Mlosa Stream in August 1967.

Between these dates, two more females and a male were secured by Dr C. H. McCleery in the Nchisi Forest, Central Province, Malawi between January and March 1967, thus extending the range of this subspecies considerably to the north.

The males agree in all essential respects with the holotype and paratype described in 1964, the only difference is in the width of the orange border of the hind wing, but this is shown to be variable, in specimens of both sexes, from the same locality.

Female. Fore wing length 54–55 mm (neallotype 55 mm, a small specimen 50 mm). Shape very similar to that of the male, but slightly less incurved on the margin at 3–4. *Upperside.* Fore wing, ground colour black, crossed by a somewhat interrupted discal white bar consisting of a thin white area on the costa, two elongate and a triangular mark at bases of 6, 5 and 4, divided by black veins, a more obliquely quadrate mark in 3 set out a little, forming an angle with marks above, a long somewhat ovoid mark in 2 with a small rounded spots at its distal end in upper part of 2b and a more triangular mark in lower portion, followed by an elongate mark in 1a extending proximad; the three lower marks in contact with the rather obscured orange-ochreous, rounded spots of the postdiscal line in these areas, the rest of the spots in the postdiscal line free, forming a gentle curve with larger more whitish spots in sub-apex 6–7. Margin with golden ochreous spots, double at the hind angle, decreasing in size up to apex. In some specimens, the marginal spots, other than those at the hind angle, missing or only faintly indicated. Hind wing, ground colour black at base shading to ashy grey on inner fold; outer border broadly black; disc of wing with a large bluish patch, ill-defined on its lower half, becoming whitish and more defined and restricted in 4–6 to subcosta, the inner border encroached on by the black ground. On the distal side of the patch there are three ill-defined ochreous spots in the postdiscal line. Submargin with a complete row of somewhat triangular bluish spots. Marginl with strong line of golden ochreous lunules, slightly separated by black veins, olive green at anae angle; edge black with narrow white fringe. Tails short and stumpy. *Underside.* For wing, ground colour olive-greyish, slightly paler at the base; cell with four black lines, narrowly outlined in bluish white, sub-base of 2 with a short black bar, and traces of lines in sub-base 1b. The discal area of the wing darker, with the white bar as above, except that the white marks in 1b are smaller; and more defined. The postdiscal row of ochreous spots, more in the form of lunules from 1b–3, accentuate the proximal edge of the conspicuous black marks at the hind angle and space above, the rest of the spots are orange-ochreous, the one at subcosta slightly whitish; the submarginal ocelli are faint; the marginal ochreous spots faint except those at hind angle. Hing wing, ground colour as fore wing, the basal black lines are thin, edged in white, those on the proximal side of the irregular white bar stronger, the white bar commencing at the subcosta fades out toward the inner fold which it faintly crosses above the anal angle; the postdiscal series of ochreous lunules, outlined black proximally, become olive above the anal angle; the admarginal pale lunules with black internally are faint, except toward the anal angle, where the black spots on an olive ground are stronger; marginal border orange, becoming olive toward the anal angle; edge greyish olive with thin whitish fringe.

Neallotype female. MALAWI: Soche Mt., 5000 feet, 26.iv.1966 (*A. J. Martin*). To be deposited in the B.M.(N.H.).

Variation (a). The specimen from the Mlosa Stream, besides being smaller, has on the upperside, the hind-marginal marks of the fore wing bar strongly lilac; the postdiscal orange spots 2–4 less clear and the marginal ochreous spots limited to the two at the hind angle. On the hind wing, the discal patch is narrower and without any orange scaling in the postdiscal line; the golden ochreous lunules on the border narrower and less clear. On the underside there is a corresponding reduction in the pattern.

Variation (b). *Upperside.* The female from the Nchisi Forest (26.iii.1967) is semi-erythristic in that the marks of the fore wing discal bar are strongly tinted with orange except for the three subcostal ones, but the mark in 1a is lilac; the postdiscal spots, except for the two subapical are orange-rufous. The marginal spots are small with the exception of the two at the hind angle. On the hind wing the discal patch is reduced in width and more purplish blue on the lower half but is shaded with orange on the upper outer border. The submarginal blue spots are small and the marginal orange is narrow and broken. *Underside.* Fore wing, strongly rufescent, the basal area of 1b blackish; the margin rusty. Hind wing, the discal area is brownish, while the discal bar is hardly indicated, except for a thin area of brownish; postdiscal marks are rusty, thinly black proximally and extending to above the anal angle; the admarginal dark spots are faint at the upper angle, but become strong in the region of the tails and double in the anal angle; accentuated with white proximad; the marginal border dull orange shading to olive at the anal angle; edge olive-grey with narrow white fringe.

Variation (c). *Upperside.* The second specimen from Nchisi (2.i.1967) is very like the neallotype on the fore wing, but the marginal orange spots are only visible at the hind angle where they coalesce. The hind wing discal patch is very narrow, slightly less shaded with bluish lilac on the borders; the submarginal lilac-blue spots distinct and the orange border strong. The underside, very similar to the type-specimen.

There is some resemblance between this race and *brevicaudatus* of the southern Highlands of Tanzania, which has a wider, more uniform white bar in the female, and specimens of *xiphares* from the Nyika Plateau (Malawi–Zambia) appear to belong to *brevicaudatus*.

Charaxes xiphares kilimensis ssp. n.

(Pl. 12, figs 96, 97)

This new subspecies of *Ch. xiphares* belongs to the north-eastern group of the species which, at the present, includes *brevicaudatus* Schultze, *maudei* Joicey & Talbot, *desmondi* van Someren and *kulal* van Someren, in which the females exhibit a departure from the usual female pattern of the more southern group, most of which have a large ochre patch in the disc of the hind wing. In the northern group the hind wing discal patch is white with strong blue scaling on the borders or overall. The fore wing discal bar is white, while the postdiscal spots, which are pronounced, are ochreous to orange-ochre.

This new subspecies from western slopes of Mt Kilimanjaro exhibits characters which place it intermediately between *brevicaudatus* of the northern end of Lake Nyasa and the southern highlands of Tanzania, which has very short tails in both sexes, and *maudei* of the Usambara Mts and possibly the Ulugurus, which has very long tails in both male and female.

MALE. Fore wing length 49 mm. *Upperside.* Fore wing, ground colour deep blue-black with strong blue sheen in side light, base of costa browner. Discal blue spots rather small, two spots just beyond end of cell, upper one a streak, spot below larger, spot sub-basal in 4 larger and round, spot below it in 3 more elongate but smaller with a minute dot beyond, no spot in 2 and spot in 1b small and round but mark in 1a an elongate streak widest proximally and tapering toward postdiscal line. Postdiscal series: two subapical in 8–7 white, spots in 6–4 slightly smaller and blue, spot in 3 slightly larger, that in 1b double. Margin without orange spots except for a slight indication in 1b. Hind wing with a large discal bluish white patch not reaching beyond 5, with strong blue suffusion on the borders, represented at the subcosta by a discrete blue spot; in the postdiscal row there are two discrete blue spots in the upper sector, but there are confluent blue marks on the outer border of the discal patch, with black scaling in between. Submarginal blue spots distinct from 2–6; border of wing with orange-rufous lunules from anal angle to 6, edged with black. Tails black, of about equal length, 4 mm. *Underside.* Fore wing, ground colour earthy grey with a slight brassy tone, the whole with a satiny sheen in side light except in mid areas of 1 and 2, which are dull; the base of the wing olive crossed by narrow black lines outlined in white; the discal spots represented in olive, proximally edged with black with a suggestion of white in between the postdiscal spots; the two upper subapical spots ochreous, the rest golden olive, the tornal mark olive to greyish distally with conspicuous double half-moon, black in centre, spot in 2 above with slight black distally. Margin with very obscure olive marks, more obvious in 1b and 2. Hind wing ground colour as fore, the sub-base crossed with zigzag olive line narrowly edged in black; the distal zone more bronzy, with a zigzag narrow whitish line from costa to 2, a narrow black line through end of cell area. Postdiscal series of spots from costa to anal angle golden olive narrowly edged with black proximally, the mark in the anal angle a long crescent double edged in black; submarginal spots bluish grey, those toward the anal with black dot distally; marginal lunules golden olive, more greenish at anal angle; edge black with very narrow white fringe. Tails mostly black with olive mid line at base.

FEMALE. Fore wing length 55 mm. *Upperside.* Fore wing, ground colour purplish brown-black in basal triangle, blacker on distal half of wing. Disc of wing crossed by a broad white curved band extending from the costa to hind margin, consisting of 4 elongate white marks, including white area on costa, beyond end of cell followed by an almost oval spot sub-basad in 3, the mark in 2 more elongate somewhat pear-shaped, the white mark in 1b double, small mark above that a blunted triangle, followed by a long streak in 1a, the marks in 1a, 1b shaded with violet scales. Postdiscal spots distinct, a large subcostal subapical mark is whitish and rounded, spot in 6 smaller, those in 5–2 smaller and orange in colour, mark in 1b double and contiguous with the discal marks. Margin with slight internervular orange marks, double in 1b. Hind wing ground colour black in basal triangle, more purplish black in dark border; disc of wing with large violet-bluish patch, more whitish toward bases of 5–6, with a large whitish quadrate mark at subcosta in 8; the discal patch itself shaded with violet and on its distal border is a series of dyslegnic rounded orangish marks from 2–5. Submargin with a series of lilac-blue spots, distinct from anal angle to 5; margin with strong orange border of confluent lunules which shade to olive green at anal angle; edge black with narrow white fringe. Tails black, 5 mm long. *Underside.* Ground colour as in the male. Fore wing, basal triangle with series of strong black lines margined with bluish white, three crossing the cell and two at end of cell, with a black spot at sub-basal of 1b and with a short bar in sub-base of 2. The discal white bar conspicuously outlined proximally in black; post-discal spot white in sub-apical area then increasingly orange to 1b, with the double black spots in 1b and 2 strongly marked; admargin with slight orange lunules strongest in 1b. Hind wing ground colour as fore wing; fine black lines outlined in white at basal triangle; discal bar represented by a pale ochre-greyish band, dyslegnic on its outer border but edged internally by a narrow black and white zigzag line; postdiscal series of rather indistinct ochreous lunules, shaded brownish in lower half, slightly more olive and more defined above anal angle; submarginal series of greyish lunules, broadly edged with black, distally touch the marginal orange-ochre lunules which shade to olive at the anal angle; extreme edge black.

Holotype male. TANZANIA: Lower slopes of west Kilimanjaro at Maua Estate, September 1966. (Collector Edmund, for Major I. Grahame.)

Allotype female. Taken in the same locality, February 1964 (*A. F. Brown*). Deposited in the B.M.(N.H.).

Range: This subspecies is at present known only from the west Kilimanjaro area.

Charaxes xiphares ludovici Rousseau-Decelle
(Pl. 12, fig. 95)

Charaxes ludovici Rousseau-Decelle, 1933 : 271.

This name was associated with subspecies *brevicaudatus* Schultze originally (van Someren, 1964 : 195) but was not formally synonymized. I am unable to form an opinion as to the validity of this race, but Major I. Grahame is of the opinion that it is sound.

The unique type is from Lake Nyassa, E. Africa. (Grahame coll.)

Charaxes xiphares desmondi van Someren

Charaxes xiphares desmondi van Someren, 1964 : 201, pl. 8, fig. 54.

It may be pointed out that the female specimen figured in the above paper is the neallotype described in the text.

SYSTEMATIC LIST

Charaxes xiphares (Cramer, 1781)

Charaxes xiphares woodi van Someren, 1964. Type locality: Malawi.
Range: Malawi.

Charaxes xiphares kilimensis ssp. n. Type locality: Tanzania: West Kilimanjaro, Maua Estate.

Charaxes xiphares ludovici Rousseau-Decelle, 1933. Type locality: Lake Nyassa.

Charaxes xiphares desmondi van Someren, 1939. Type locality: S.E. Kenya, Teita Range.

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INDEX

Synonyms in italics

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PLATE 1

Charaxes

Upper and undersides

FIG. 1. *hildebrandti hibldevandti* Dewitz, ♀.
FIG. 2. *hildebrandti hildebrandti* Dewitz, ♀.
FIG. 3. *hildebrandti katangensis* Talbot, ♂ (Congo: Katanga, Lulua) (*F. G. Overlaet*). Photos I. Grahame.
FIG. 4. *thysii* Capronnier, ♀ (French Equatorial Africa) (Jackson coll.).
FIG. 5. *hadrianus hadrianus* Ward, ♂ (Congo: Katanga, Kafakumba). Photos I. Grahame.
FIG. 6. *hadrianus hadrianus* Ward, ♀ (Congo: Katanga, Kafakumba). Photos I. Grahame.
FIG. 7. *hadrianus lecer¼* Lathy, ♀ (Ghana Forest) (*L. R. Cole*). Photos B.M.(M.H.) Nos 51274–5.
FIG. 8. *hadrianus lecer¼* Lathy, ♂ (Nigeria: Warri) (Rothschild coll.). Photos B.M.(N.H.) Nos 50120–1.
FIG. 9. *hadrianus* ? ssp. n. ♀ (Sierra Leone: Kanbui Hills, Bamba-wo) (*G. D. Field*). Photos B.M.(N.H.) Nos 512–667.

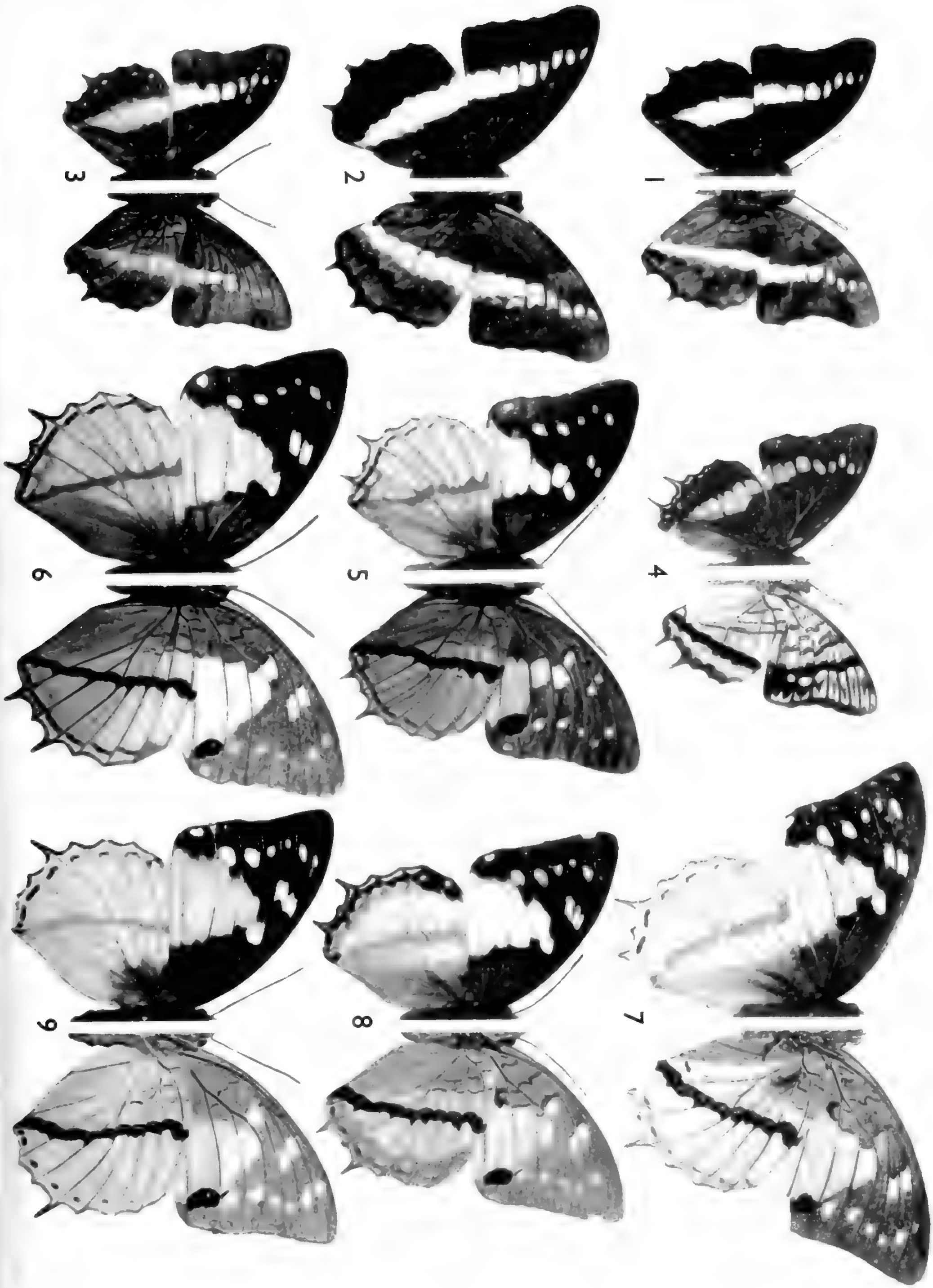

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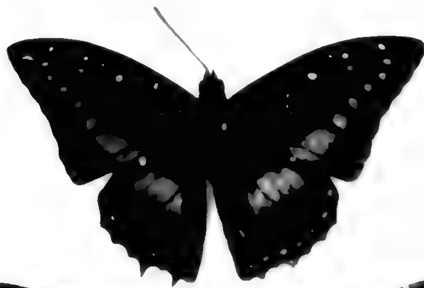
PLATE 2

Charaxes

Upper and undersides

FIGS 10 & 11.	*imperialis* Butler, ♂ Type (Gold Coast [Ghana]). Photos B.M.(N.H.) Nos 50132–3.
FIGS 12 & 13.	*imperialis* Butler, ♀ Type (Gold Coast [Ghana]). Photos B.M.(N.H.) Nos 50138–9.
FIG. 14.	*imperialis* Butler, ♂ (Nigeria: Ikom).
FIG. 15.	*imperialis* Butler, ♀ (Ivory Coast: Banco-Abidjan). Photos J. Plantrou.
FIGS 16 & 17.	*albipunctus* Joicey & Talbot, ♂ Paratype (Cameroun). Photos B.M.(N.H.) Nos 50134–5.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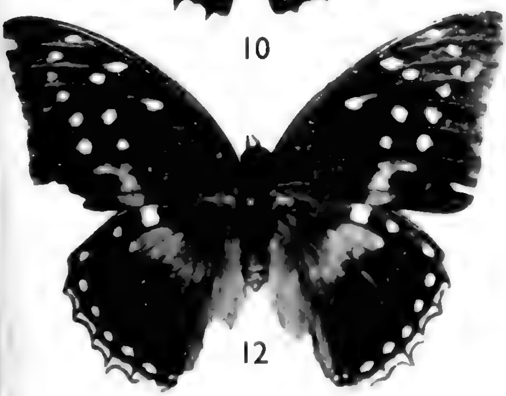
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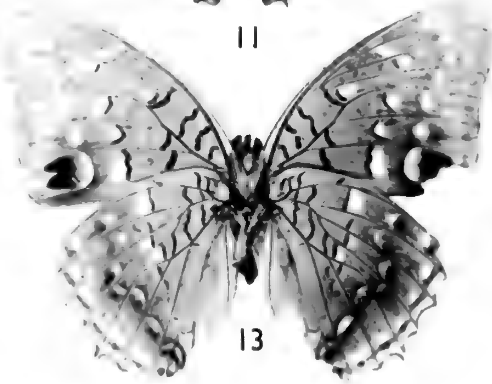
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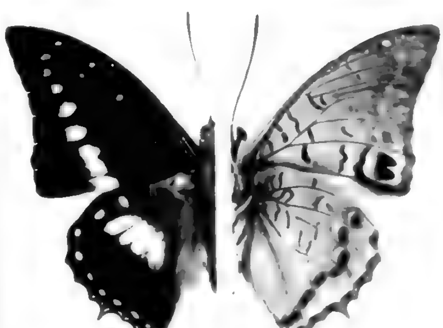
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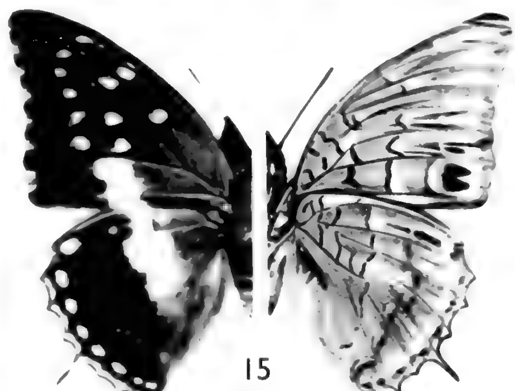
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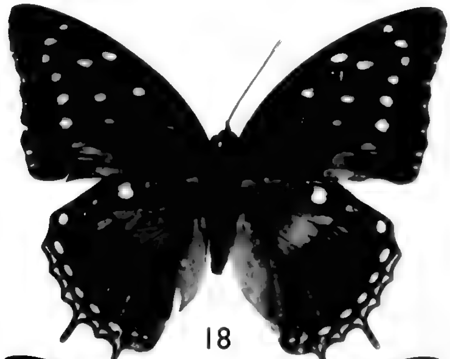
PLATE 3

Charaxes

Upper and undersides

Figs 18 & 19.	*albipunctus* Joicey & Talbot, ♀ Allotype (Cameroun). Photos B.M.(N.H.) Nos 50136–7.
Fig. 20.	*imperialis*, ♂ transitional to *albipunctus* Joicey & Talbot (Uganda: Bwamba Valley, E. side Semliki River).
Fig. 21.	*imperialis*, ♀ transitional to *albipunctus* Joicey & Talbot (Uganda: Bwamba Valley, E. side Semliki River).
Fig. 22.	*imperialis*, ♀ form *caerulipunctus* forma n. Holotype (Uganda: Bwamba Valley) (*I. Grahame* coll.). Postdiscal spots fore wing blue; hind wing blue patch extended towards inner fold, costal spots large and bluish white.
Fig. 23.	*ugandicus* ssp. n., ♂ Holotype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (van Someren coll.).
Fig. 24.	*ugandicus* ssp. n., ♀ Allotype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (*van Someren*).



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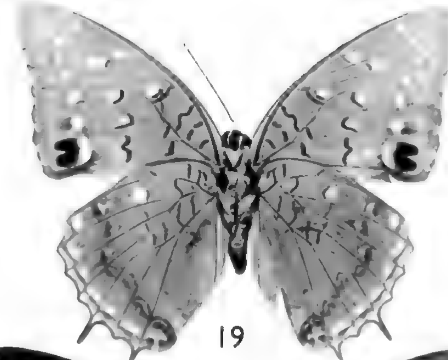

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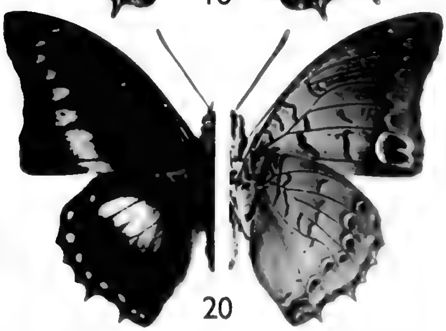

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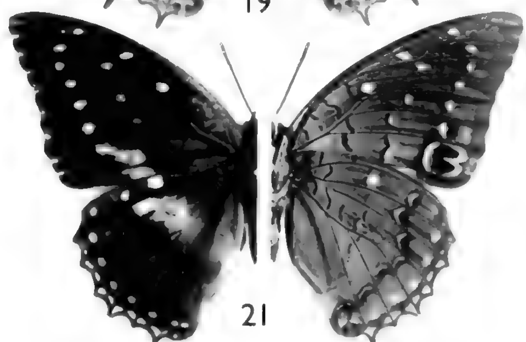

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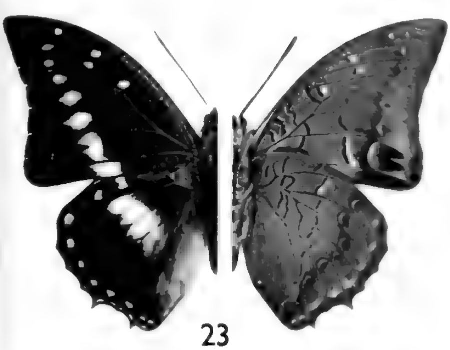

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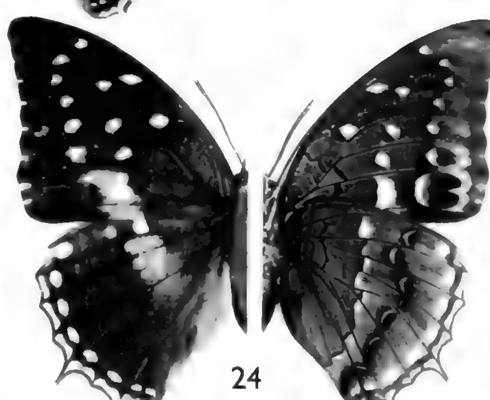

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PLATE 4

Charaxes

Upper and undersides

FIG. 25.	*imperialis paulianus* Rousseau-Decelle, ♂ Type (Congo: Katanga, Kafakumba). Photos J. Plantrou.
FIG. 26.	*imperialis paulianus* Rousseau-Decelle, ♀ Type (Congo: Katanga, Kafakumba). Photos J. Plantrou.
FIG. 27.	*imperialis ludovici* Rousseau-Decelle, ♂ (Zambia: Mwinilunga) (*C. B. Cottrell*).
FIG. 28.	*imperialis ludovici* Rousseau-Decelle, ♀ (Zambia: Mwinilunga) (*C. B. Cottrell*).
FIG. 29.	*ameliae ameliae* Doumet, ♂ (Ivory Coast).
FIG. 30.	*ameliae ameliae* Doumet, ♀ (Ivory Coast).
FIGS 31 & 32.	*ameliae victoriae* ssp. n., ♂ Holotype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (*van Someren*).

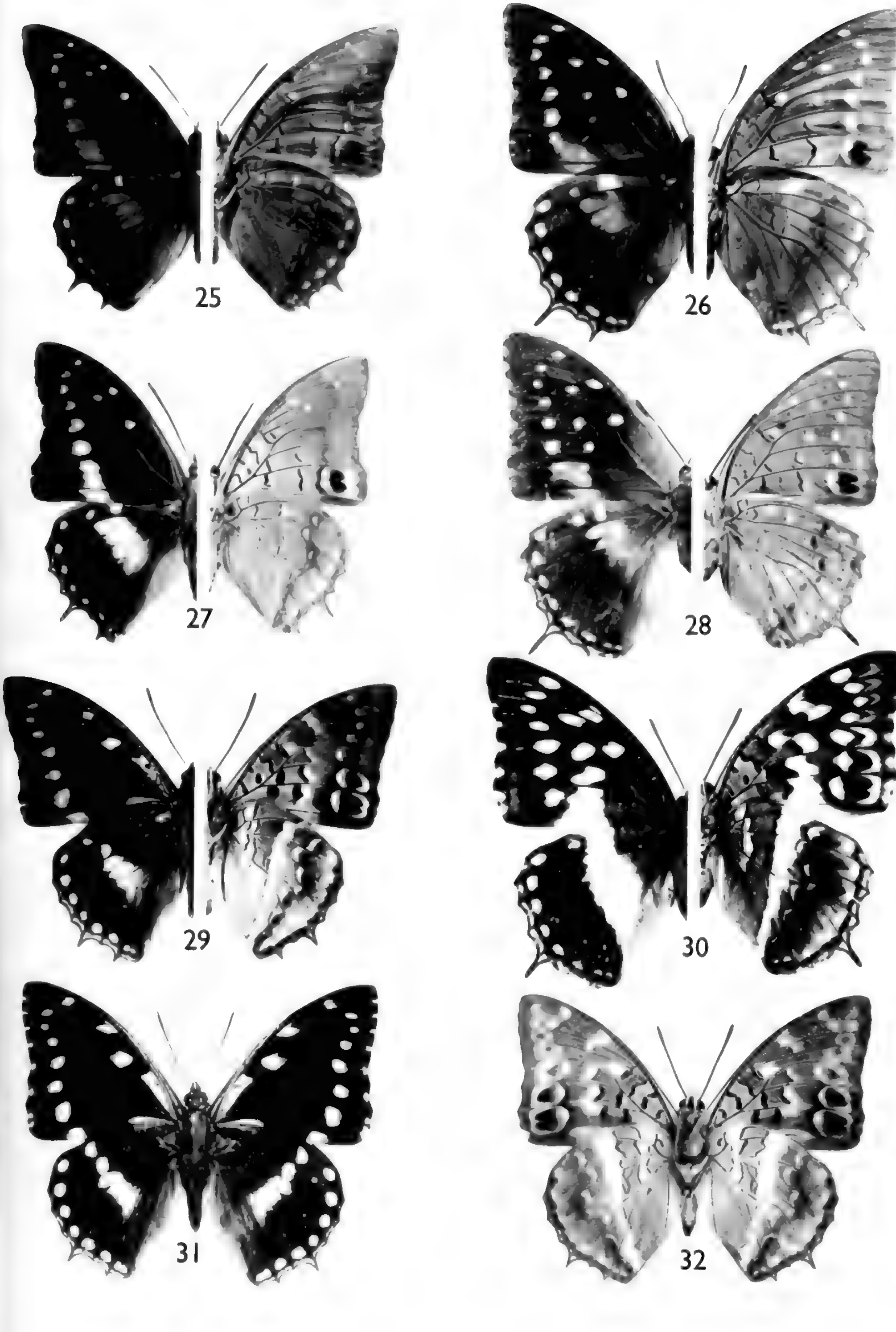
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PLATE 5

Charaxes

Upper and undersides

FIGS 33 & 34.	*ameliae victoriae* ssp. n., ♀ Allotype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (*van Someren*).
FIG. 35.	*ameliae victoriae* ssp. n., ♂ Paratype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (*van Someren*).
FIG. 36.	*ameliae victoriae* ssp. n., ♀ Paratype (Uganda: Masaka district, Katera Forest, W. shore Lake Victoria) (*van Someren*).
FIG. 37.	*ameliae amelina* Joicey & Talbot, ♂ (Malawi: Nkata Bay, Lake Nyasa).
FIG. 38.	*ameliae amelina* Joicey & Talbot, ♀ (Malawi).
FIG. 39.	*ameliae amelina* Joicey & Talbot, ♀ (Malawi).
FIG. 40.	*lactetinctus lactetinctus* Karsch, ♂ Holotype (Togo). Photos B.M.(N.H.) Nos 50140–1.

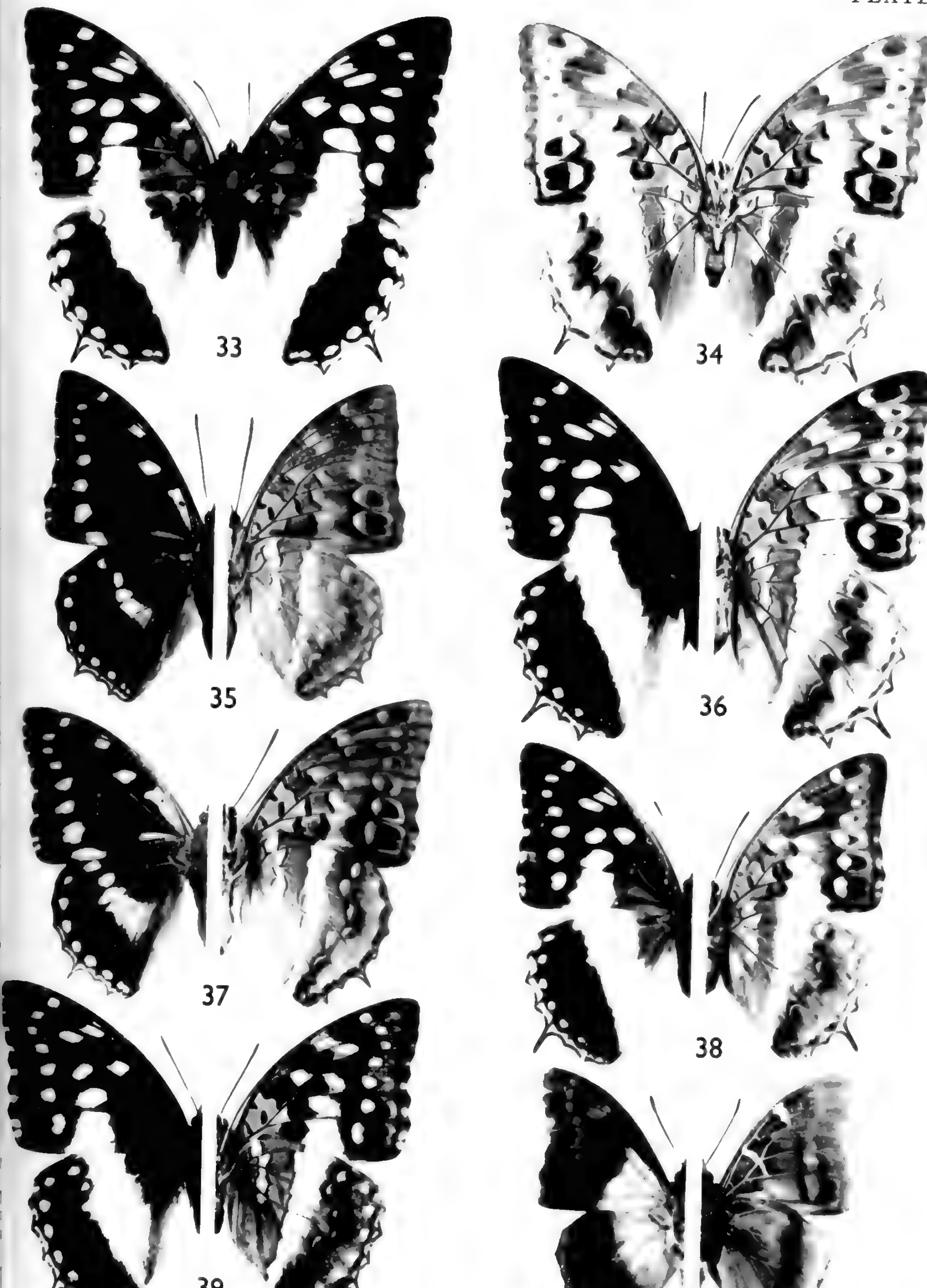
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PLATE 6

Charaxes

Upper and undersides

FIG. 41.	*lactetinctus* Karsch, ♂ (Gold Coast [Ghana]).
FIG. 42.	*lactetinctus* Karsch, ♀ (Nigeria).
FIGS 43 & 44.	*busogus* ssp. n., ♂ Holotype (Kenya: Busoga district, Broderick Falls Scarp) (*van Someren*).
FIGS 45 & 46.	*busogus* ssp. n., ♀ Allotype (Uganda: Metu Hills, N. W. Madi, W. Nile, v–vi.1954) (*van Someren*).
FIGS 47 & 48.	*busogus* ♀ form *jacksonianus* van Someren (N.W. Kenya).

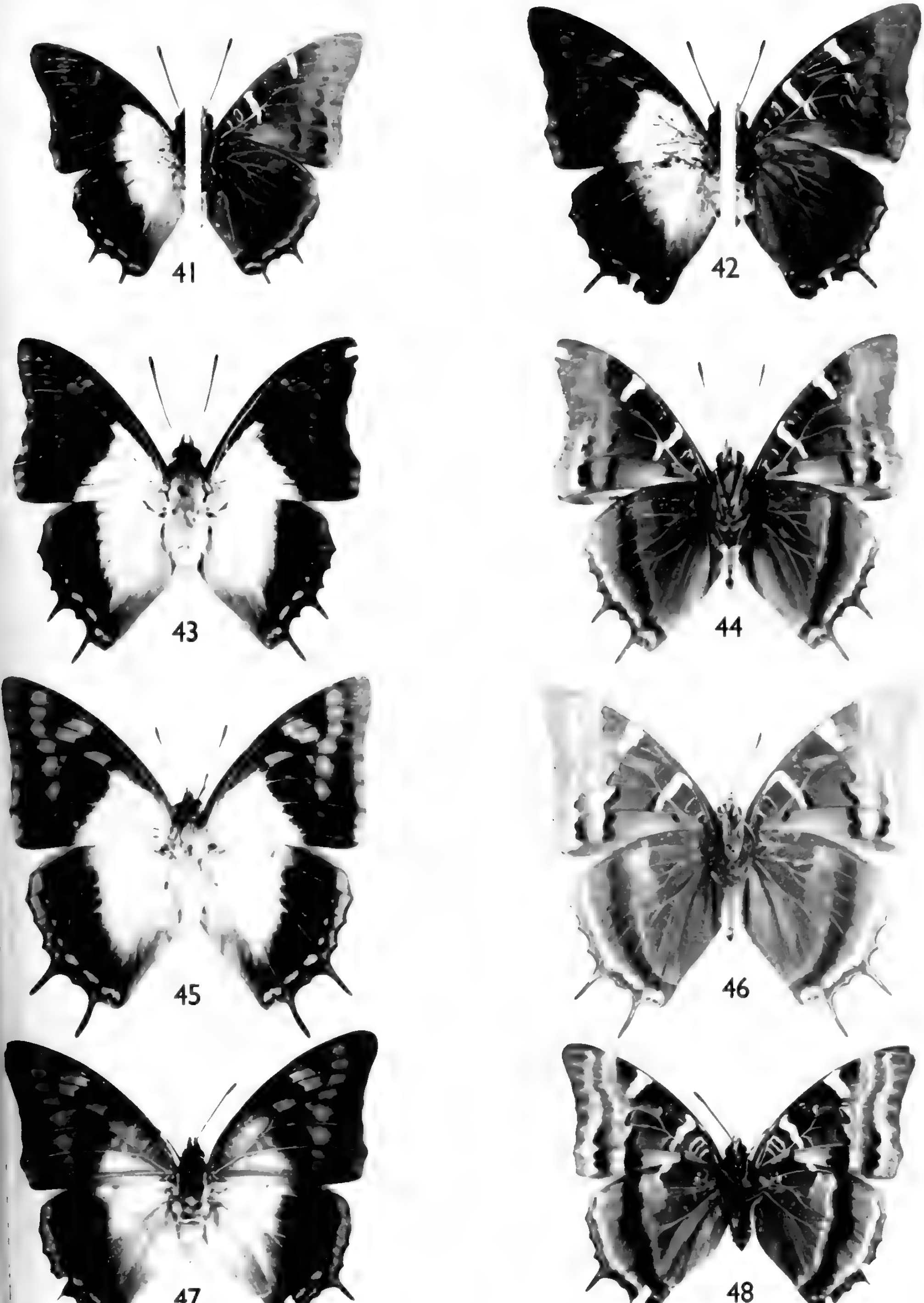
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PLATE 7

Charaxes

Upper and undersides

FIG. 49. *lactetinctus ungemachi*, ♂ form *brunneus* Carpenter (Ethiopia: Youbdo).
FIG. 50. *lactetinctus ungemachi* Le Cerf, ♀ Paratype (Ethiopia: Youbdo).
FIG. 51. *tiridates tiridatinus* Rober, ♀ (Uganda).
FIG. 52. *tiridates tiridates* Cramer, ♂ (Ivory Coast).
FIG. 53. *tiridates tiridatinus* Rober, ♀ (Uganda).
FIG. 54. *tiridates tiridates* Cramer, ♀ (Ivory Coast).
FIG. 55. *tiridates tiridatinus* Rober, ♂ (S.W. Uganda: Kayonza).
FIG. 56. *tiridates tiridatinus* Rober, ♂ (N.W. Kenya).

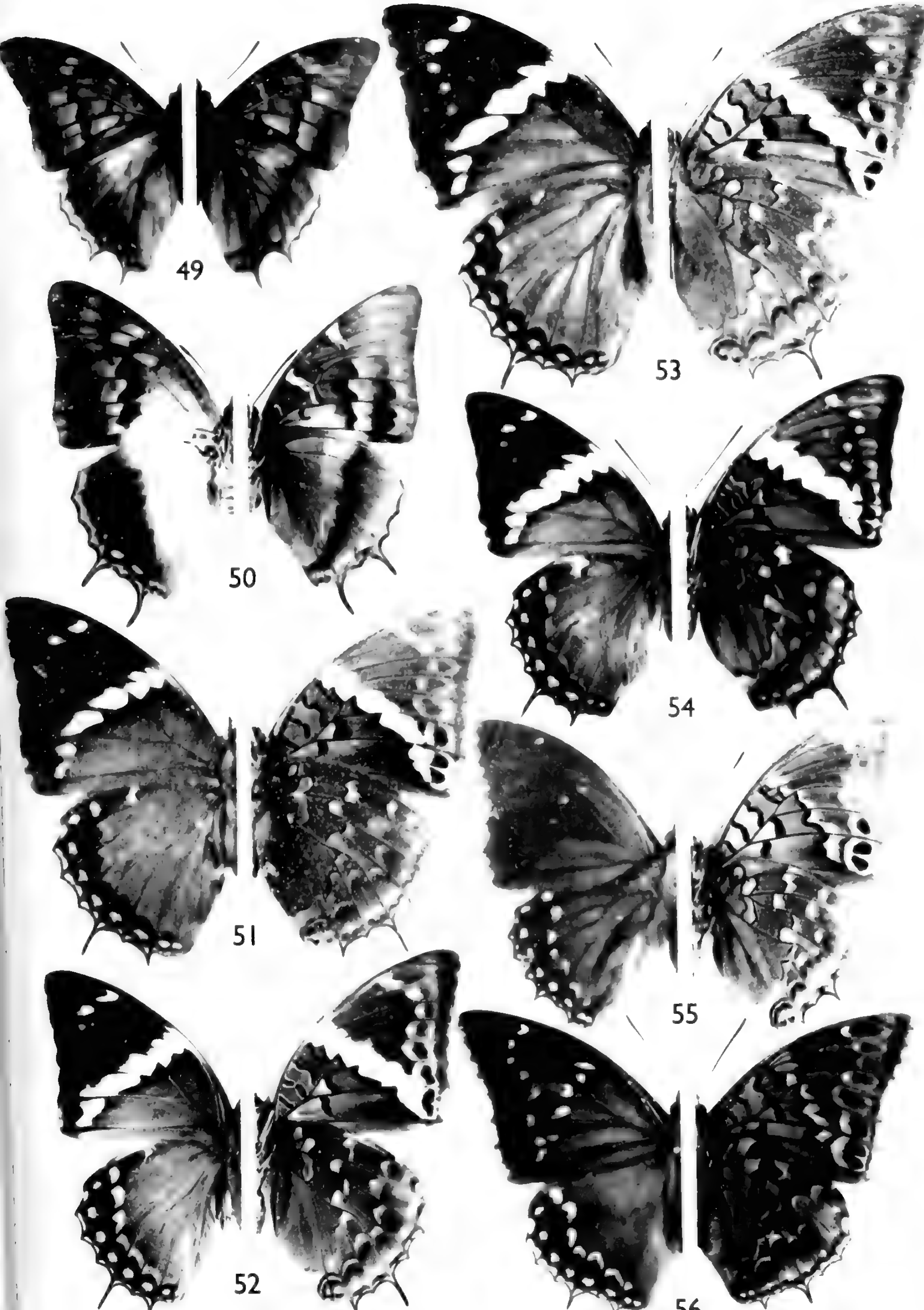
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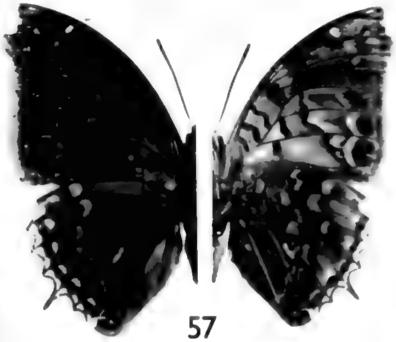
PLATE 8

Charaxes

Upper and undersides

Fig. 57.	*tiridates marginatus* Rothschild, ♂ Holotype (Ethiopia: Sheko, 25.iv.1901).
Fig. 58.	*tiridates marginatus* Rothschild, ♂ (Ethiopia).
Fig. 59.	*fuscus* Plantrou, ♂ Holotype (Central African Republic: Bangui, ix.1966) (*R. P. Godart*).
Fig. 60.	*numenes numenes* Hewitson, ♂ (Ivory Coast).
Figs 61 & 62.	*numenes numenes* Hewitson, 2 ♀ (Ivory Coast).
Fig. 63.	*numenes* Hewitson, ♂ intermediate cline (Central African Republic: Bangui).
Fig. 64.	*numenes* Hewitson, ♀ intermediate cline (Central African Republic: Bangui).



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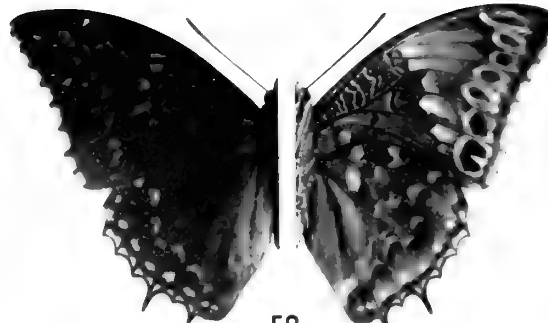

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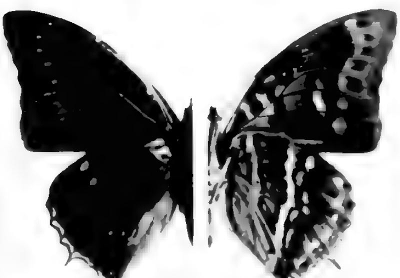

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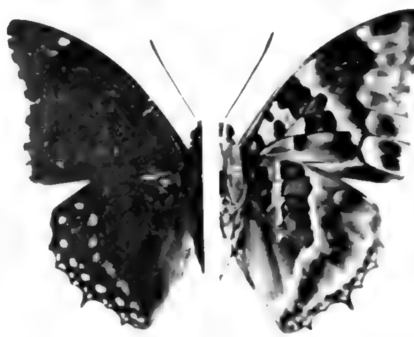

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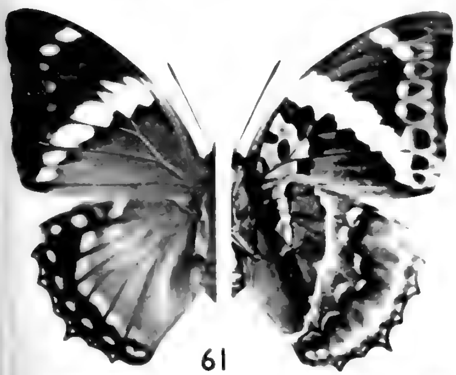

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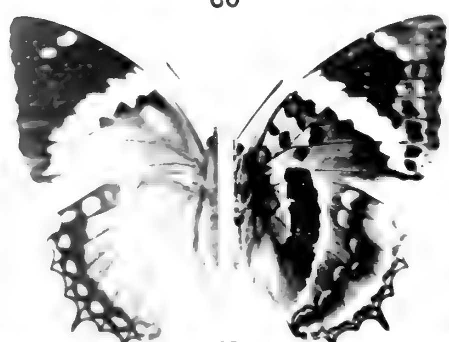

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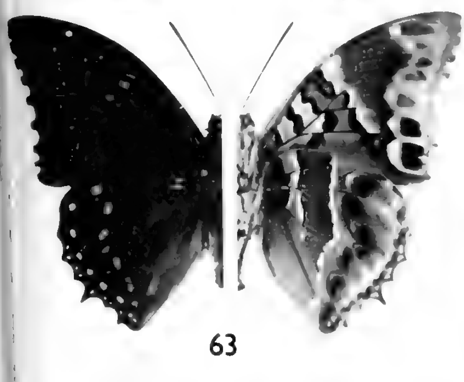

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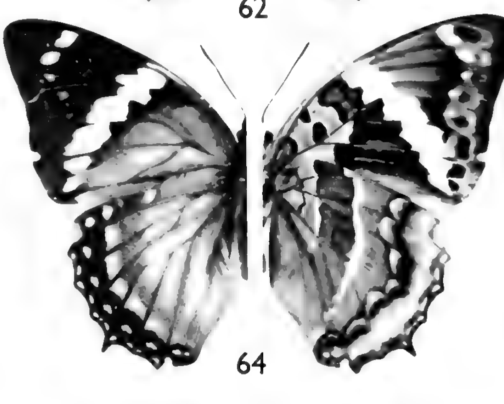

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PLATE 9

Charaxes

Upper and undersides

FIG. 65. *numenes aequatorialis* ssp. n., ♂ Holotype Uganda: Kayonza, Kigezi, 6.ix.1952) (*van Someren*).

FIG. 66. *numenes aequatorialis* ssp. n., ♀ Allotype (Uganda: Kayonza Forest, Kigezi, v–vi.1957) (*van Someren*).

FIG. 67. *numenes neumanni* Rothschild, ♂ Holotype (Wori-Gamitscha Kaffa, 5.xi.1901). Photos B.M.(N.H.) Nos 49045–6.

FIG. 68. *numenes neumanni* Rothschild, ♂ (Ethiopia: Lalo Kel) (Joicey Bequest). Photos B.M.(N.H.) Nos 46086–7.

FIG. 69. *bipunctatus bipunctatus* Rothschild, ♂ Holotype (Ghana). Photos B.M.(N.H.) Nos 49040–1.

FIG. 70. *bipunctatus bipunctatus* Rothschild, ♀ Allotype (Ghana). Photos B.M.(N.H.) Nos 49038–9.

FIG. 71. *bipunctatus bipunctatus* Rothschild ♂ (Ghana).

FIG. 72. *bipunctatus* Rothschild, ♀ (Ghana).


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PLATE 10

Charaxes

Upper and undersides

FIG. 73. *bipunctatus ugandensis* ssp. n., ♂ Holotype (Uganda: Toro Forest (J.) x.1949) (*van Someren*).

FIG. 74. *bipunctatus ugandensis* ssp. n., ♀ Allotype (Uganda: Toro, Kibali Forest, v–vi.1956) (*van Someren*).

FIG. 75. *bipunctatus ugandensis* ssp. n., ♂ Paratype (S.W. Uganda: Kayonza Forest).

FIG. 76. *mixtus* Rothschild, ♂ Holotype (Lokolele, mid Congo River). Photos B.M.(N.H.) Nos 46082–3.

FIG. 77. *mixtus* Rothschild ♂.

FIG. 78. *mixtus* Rothschild ♂.

FIG. 79. *mixtus* Rothschild ♀.

FIG. 80. *bubastis* Schultze ♂ (Cameroun: Bipindi) B.M.(N.H.).

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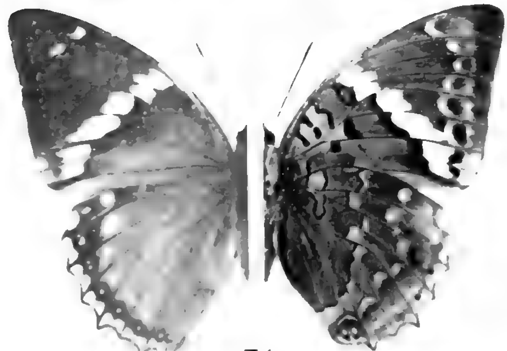

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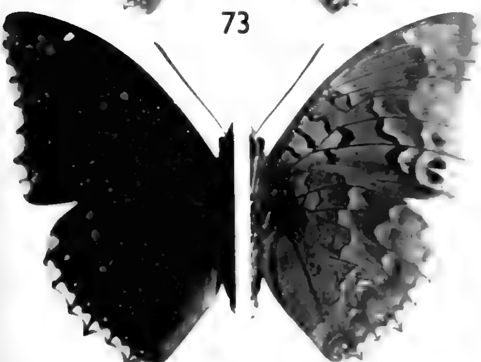

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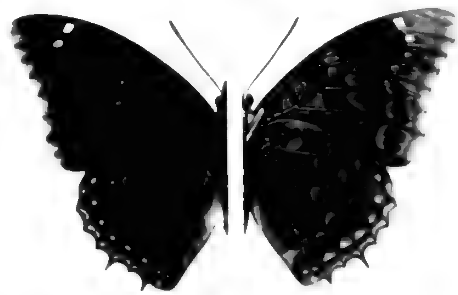

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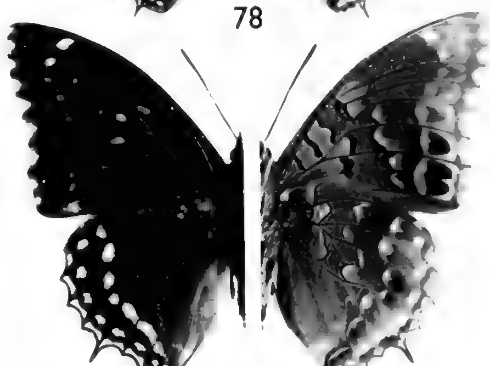

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PLATE 11

Charaxes

Upper and undersides

FIG. 81. *albimaculatus* ssp. n., ♂ Holotype (Congo: Stanleyville) (Ertl. coll. ex Joicey Bequest) B.M.(N.H.).

FIG. 82. *albimaculatus* ssp. n., ♀ Allotype (S. Congo: Kafakumba, Katanga) (Overlaet coll. ex Le Moult, in coll. J. Plantrou).

FIG. 83. *barnesi* Joicey & Talbot, ♂ (Island of Principe, Gulf of Guinea, iv–v.1926). Photos B.M.(N.H.) Nos 46078–9.

FIG. 84. *barnesi* Joicey & Talbot, ♀ (Island of Principe, Gulf of Guinea iv–v.1926). Photos B.M.(N.H.) Nos 46084–5.

FIGS 85 & 86. *manica subrubidus* ssp. n., ♂ Holotype (Congo: Brazzaville, x.1966) (*J. Plantrou*).

FIGS 87 & 88. *manica subrubidus*, ♀ form *atribasis* forma n., Holotype (Congo: Brazzaville, 19.ix.1966) (*J. Plantrou*).


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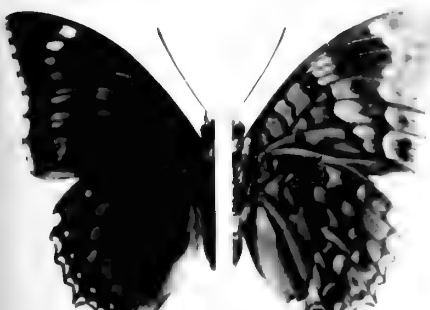
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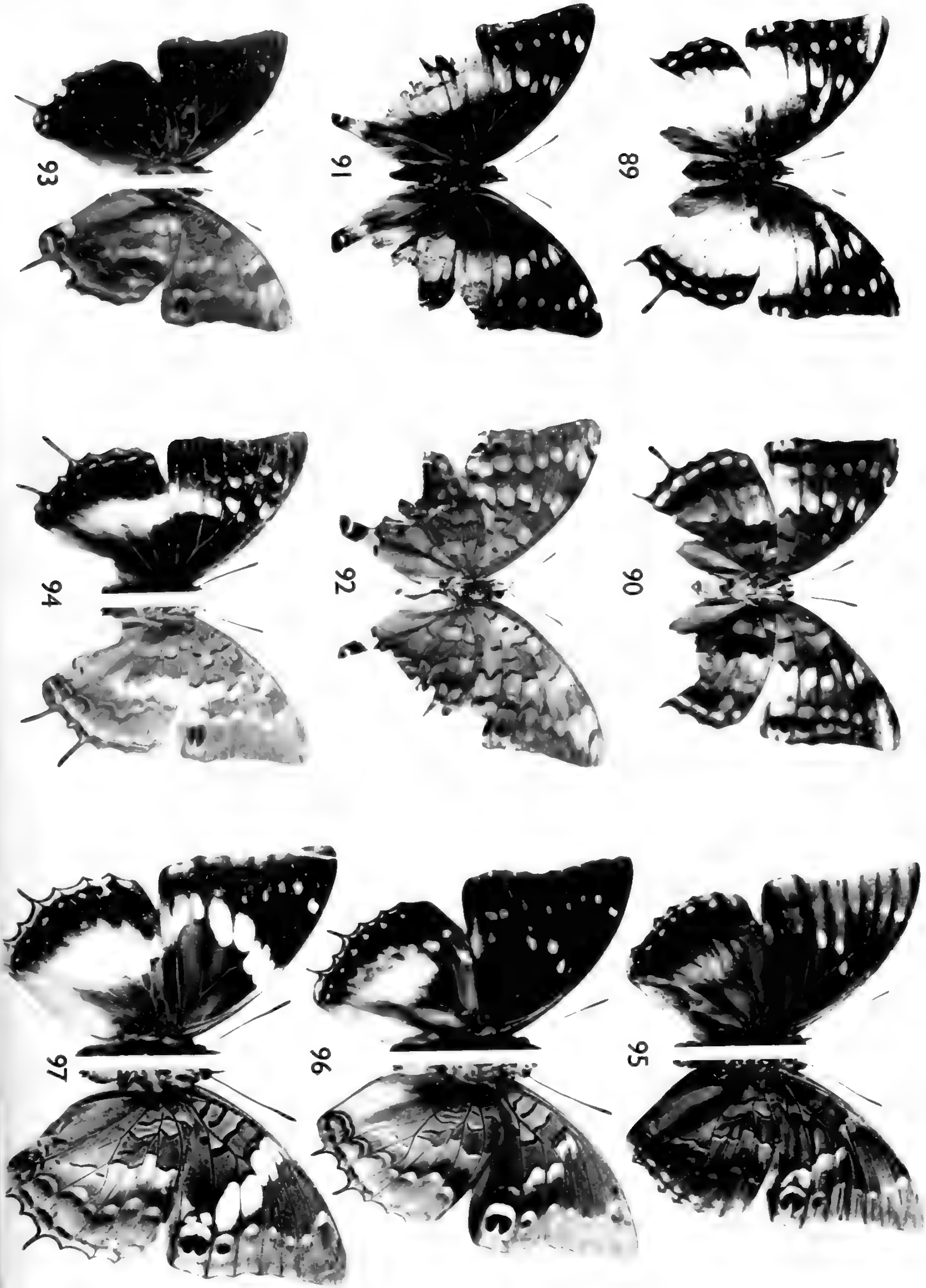
PLATE 12

Charaxes

Upper and undersides

Figs 89 & 90.	*manica subrubidus*, ♀ form *aubergeri* forma n., Holotype (Congo: Brazzaville, 25.v.1967) (*J. Plantrou*).
Figs 91 & 92.	*manica subrubidus*, ♀ form *pseudosmaragdalis* van Someren & Jackson.
Fig. 93.	*mccleeryi* sp. n., ♂ Holotype (Tanzania: Bundaki Hills, Uluguru Mts, 6000 ft, vii.1966) (*C. H. McCleery*).
Fig. 94.	*mccleeryi* sp. n., ♀ Allotype (Tanzania: Bunduki Hills, Uluguru Mts, 6000 ft, vii.1966) (*C. H. McCleery*).
Fig. 95.	*xiphares ludovici* Rousseau-Decelle, ♂ Type (Malawi: Lake Nyasa) (I. Grahame coll.).
Fig. 96.	*xiphares kilimensis* ssp. n., ♂ Holotype (Tanzania: Lower slopes W. Kilimanjaro, Maua Estate, ix.1966) (*Edmund*).
Fig. 97.	*xiphares kilimensis* ssp. n., ♀ Allotype (Tanzania: Lower slopes W. Kilimanjaro, Maua Estate, ii.1964) (*A. F. Brown*).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Z. BOUČEK

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ENTOMOLOGY Vol. 27 No. 5
LONDON: 1972

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BY

ZDENĚK BOUČEK

Commonwealth Institute of Entomology

Pp 265–315; 62 *Text-figures*

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SYNOPSIS

This paper supplements Graham's recent work (1969) in revising the European species of several genera of Pteromalidae and giving descriptions of new taxa. Most of the 14 new species are from central and southern Europe. In *Cleonymus* three species are recognized including two new ones, in *Eunotus* nine species (two new), in *Spaniopus* seven species (two new). Also described are five new species belonging to four new genera, one of them in the subfamily Miscogasterinae, the other three in the Pteromalinae. In *Peridesmia* one new species is added to the two previously known; similarly one species is described in *Semiotellus* and one in *Pteromalus*. The study of extensive fresh material and of the relevant types results in better recognition of some species and in the establishment of four new specific synonyms.

INTRODUCTION

THE magnificent and most useful monograph of the Pteromalidae of north-western Europe by Graham (1969) covers the Pteromalid fauna of Europe to a greater extent than its title would suggest. Where possible, it provides keys to the European genera and species.

In some groups, apparently, most species have already been described but in some other groups information is still very incomplete. It is mainly in the latter groups that rich material has been collected together and the present contribution is the result of its study. This paper may therefore be regarded as a supplement to Graham's work.

The taxa are classified in the same way and described mainly in the same form. The morphological terms are also used mainly in the same sense as Graham, except for the following.

Prepectus is used instead of *postspiracular sclerite,* for in the more primitive Chalcidoids it forms an unbroken belt in front of the mesopleurae, so that 'post-spiracular sclerite', pointing to an independent sclerite on each side of the thorax (as it occurs generally in more apomorph forms) does not seem quite as appropriate as the older term 'prepectus'.

The *mesopleura* of the thorax is divided by the oblique pleural line running from the base of the mid coxa towards the base of the fore wing (where it branches) into the anteroventral *mesepisternum* and posterodorsal *mesepimeron.* The mesepimeron is usually subdivided into the upper and lower epimeron. Graham calls only the lower part epimeron and considers the upper, frequently smooth part, as belonging to the mesepisternum, following Thomson.

The gastral *tergites* are counted, as Graham does in the text, i.e., the basal, post-petiolar tergite as the first, the spiracle-bearing tergite as the sixth.

The following abbreviations are used for depositories of the collections:

BMNH—British Museum (Natural History), London.
IEE, Madrid—Instituto Español de Entomología, Madrid, Spain.
MCSN, Genoa—Museo Civico di Storia Naturale, Genoa, Italy.
MHN, Geneva—Muséum d'Histoire Naturelle, Geneva, Switzerland.
MNHN, Paris—Muséum National d'Histoire Naturelle, Paris, France.
MNHU, Berlin—Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany.
NM, Dublin—National Museum of Ireland, Dublin.
NM, Prague—Národní Museum, Prague, Czechoslovakia.
NM, Vienna—Naturhistorisches Museum, Vienna, Austria.
TM, Budapest—Természettudományi Múzeum, Budapest, Hungary.
USNM, Washington—U.S. National Museum, Washington, U.S.A.
UZI, Lund—Universitetets Zoologiska Institution, Lund, Sweden.
UZM, Copenhagen—Universitetets Zoologiske Museum, Copenhagen, Denmark.
ZI, Leningrad—Zoological Institute of the Academy of Sciences of the U.S.S.R., Leningrad.
ZIPF, Zagreb—Zoološki Institut Poljoprivrednog Fakulteta, Zagreb, Yugoslavia.

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CLEONYMINAE

CLEONYMUS Latreille

Cleonymus Latreille, 1809 : 29. Type-species: *Diplolepis depressa* (Fabricius); designated by Latreille, 1810.

The subsequent references are quoted by Graham (1969) and are not repeated here.

Kerrich & Graham (1957) and Graham (1969) recognize two European species, *C. laticornis* Walker and *C. obscurus* Walker. A study of further material revealed two new species in southern Europe and threw doubts on the validity of *C. obscurus*.

Key to European Species

1 Frons in front of ocelli deeply regularly punctured, with narrow smooth interspaces between punctures (Text-fig. 4); vertex 1·36–1·48 times as broad as the relatively small eye. Fore wing in ♀ with hairs uniformly dark and long, even on the subhyaline spot below marginal vein (Text-fig. 2); infuscation of wing strong below postmarginal and stigmal vein but weak or absent below parastigma; marginal vein fully 1·9 times as long as the stigmal. Fifth tergite in ♀ in middle more than twice as long as the fourth and itself about 0·9 times as long as broad, coarsely raised-reticulate except along hind margin. Lateral ocellus about 1·6 times its diameter from eye margin. ♂ unknown. (Balkan Peninsula) . ***balcanicus*** sp. n. (p. 270)

– Frons sculpture different, either shagreened or rugulose; eyes usually larger, often as broad as the vertex. Fore wing in ♀ at least with some dense white hairs on hyaline spot below marginal vein, the latter at most 1·72 times as long as the stigmal. Fifth tergite in the middle at most 1·6 times as long as the fourth and itself at most 0·8 times as long as broad, its sculpture rather weak. Ocelli relatively larger, the lateral one at most about 1·15 its diameter from eye 2

2 ♀. Body stout, gaster at most about twice as long as broad (Text-fig. 5), distinctly broader than the thorax, only 0·9–1·16 times as long as head plus thorax combined. Head in dorsal view 2–2·15 times as broad as long, frons above shiny, shagreened (Text-fig. 9), piliferous punctures small. Scutellum usually transverse. Marginal vein less than 1·6 times as long as the stigmal. Fifth tergite at least twice as broad as long in the middle. ♂. Marginal vein hardly longer than the postmarginal, at most 1·5 times as long as the stigmal . . . ***brevis*** sp. n. (p. 272)

– ♀. Body slender, gaster at least 2·4 times as long as broad, at most only slightly broader than (1·02–1.1, if flattened then at most 1·2 times as broad as) the thorax. Head in dorsal view at least 2·2 times as broad as long, frons in front of ocelli very densely irregularly rugulose, usually dull. Scutellum usually slightly elongate. Marginal vein at least 1·7 times as long as the stigmal. Fifth tergite less transverse. ♂. Marginal vein distinctly longer than the postmarginal and 1·8–1·9 times as long as the stigmal . ***laticornis*** Walker (and ***obscurus*** Walker) (p. 283)

Cleonymus balcanicus sp. n.
(Text-figs 1–4)

♀. Head and thorax mainly cupreous, in places sometimes with a weak bluish or greenish tint; propodeum and gaster bluish black or bronzy black, hind coxae dark green dorsally, bright cupreous laterally. Antennae and legs mainly dark rufous, but pedicel, first flagellar segment, preclava and clava more or less infuscate; fore tibia sometimes externally with bluish tint, mid and hind tibiae dorsally more or less infuscate; tarsi pale testaceous, infuscate apically. Fore wing with an extensive brown cloud on disc extending to postmarginal vein and basad usually as far as below parastigma (Text-fig. 2); a small infuscation indicated also along hind margin in second quarter of wing. Hind wing subhyaline. Length 4·4–5·6 mm (the latter the holotype).

Head distinctly broader than mesoscutum (as 1·2–1·25 to 1), dorsally about 2·3–2·4 times as broad as long, with inner eye-margins slightly diverging forward. POL : OOL about as 1·7 to 1. Head in facial view (only head capsule measured, excluding mandibles) 1·42–1.44 times as broad as high. Ocelli relatively small, the lateral one more than 1·5 times its diameter from eye. Frons in front of ocelli simply reticulate-punctured, interspaces narrow but distinct, smooth (Text-fig. 4); face further down at sides with meshes more lengthened, slightly rugose-reticulate; the same in transverse sense on vertex behind ocelli; upper frons not distinctly angulately or sculpturally separated from the lower (more vertical) part, scrobes also not indicated. Relative measurements: head width 82, height 57, frons (minimum distance between eyes) 41, eye 36·5 : 30, malar space 23, mouth width 33, scapus length 24, flagellum plus pedicellus combined about 67. Antenna similar to that of *C. laticornis*, only slightly stouter, all segments between pedicel and clava moderately transverse (in *laticornis* fourth flagellar segment usually slightly longer than broad); pedicellus as long as two following segments combined, the first of them shorter than the second; processus of preclava broad and only about as long as the body of preclava.

Dorsum of thorax with relatively coarse, deep and fairly regular reticulation-punctation and rather coarse but uniform whitish pubescence (as in *C. laticornis*). Scutellum about 1·1 times as long as broad, feebly convex, reticulation on its disc shallower than that on mesoscutum, axillar furrows anteriorly only moderately deep. Propodeum in the middle 0·45–0·5 times as long as scutellum, the median part superficially very weakly reticulate, much as in *laticornis*, but posterior flange laterad of nucha in dorsal view not quite as broad as the crenulate furrow basally at metanotal margin. Metapleura not very densely hairy. Mesepimeron in middle with deep fovea as a part of the curved groove separating the reticulate lower epimeron, the fovea not reaching metanotal margin; upper mesepimeron nearly smooth on disc but finely rugulose at sides, in particular anteriorly. *Fore wing* about 2·7 times as long as broad, infumate all over, with darker brown markings as given in the key (Text-fig. 2), its pubescence relatively rough, dark, not paler on pale parts of the wing blade. Relative measurements (on the holotype): costal cell 90 : 10, marginal vein 44, postmarginal vein 37, stigmal vein 23, maximum distance between upper edge of stigma and the postmarginal vein 6·6. Marginal vein 1·9–1·96 times as long as the stigmal.

Gaster 1·1–1·2 times as long as head plus thorax combined, about 2·6 times as long as broad itself, distinctly flattened dorsally, about 1·1 times as broad as thorax, broadest just behind middle, i.e., at basal half of fifth (postpetiolar) tergite. First tergite mainly smooth, following

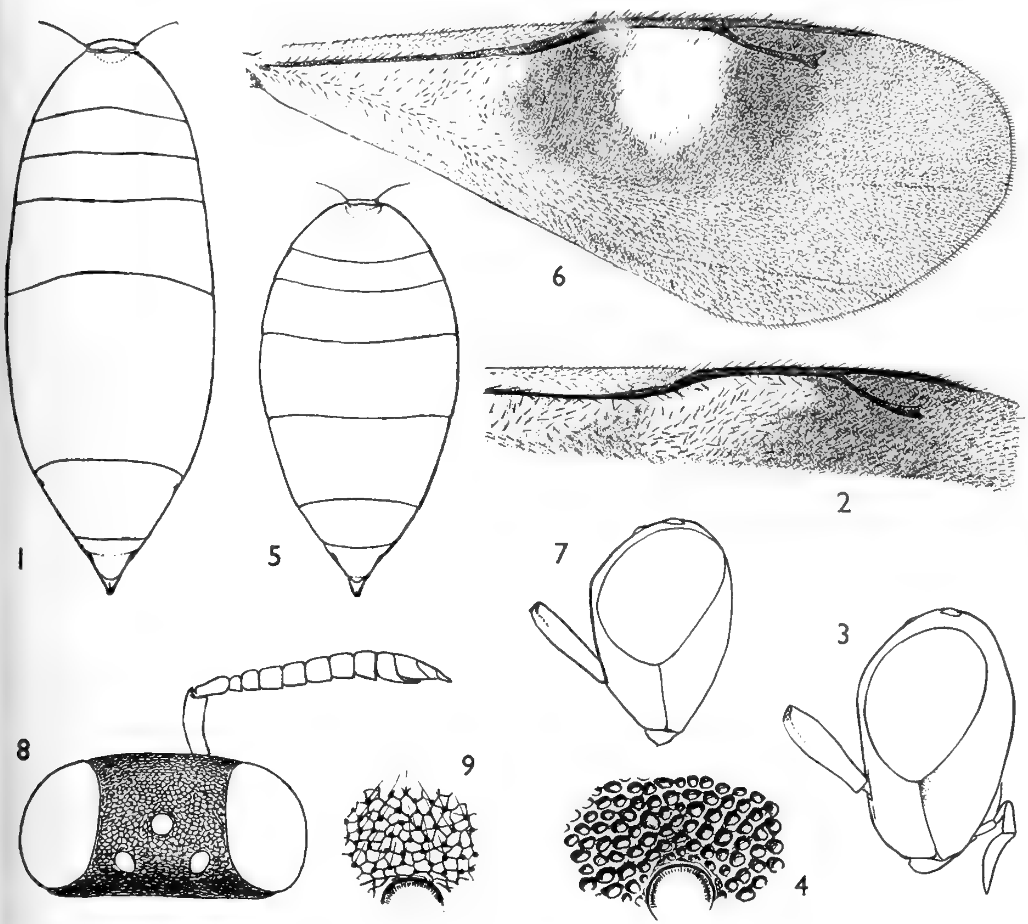
tergites with a smooth belt along hind margin. Otherwise gaster dorsally reticulate, very coarsely so on the fifth tergite. This tergite is the largest (Text-fig. 1), nearly as long as tergites 1 to 4 taken together (in median line), 0·89–0·95 times as long as broad itself. Hind margins of first, fourth and fifth tergites broadly shallowly emarginate. Hypopygium hardly reaching one-third of gaster. Hairs of gaster anteriorly whitish, posteriorly blackish.

♂. Unknown. It might be recognizable by the sculpture of head.

BIOLOGY not known.

Holotype ♀. GREECE: Attiki, Cape Sunion, SE of Athens, 7.iv.1917 (*Fodor*); in TM, Budapest.

Paratype. BULGARIA: 1 ♀, 7.vii.1964 (*Strejček*); in Bouček Collection.



FIGS 1–9. *Cleonymus*. 1–4. *C. balcanicus*, 1, gaster of ♀; 2, part of fore wing with pilosity and infuscation indicated; 3, head in lateral view; 4, sculpture on frons in front of median ocellus. 5–9. *C. brevis*, 5, gaster of ♀; 6, fore wing of ♀; 7, head in lateral view; 8, head of ♀ with antenna; 9, type of sculpture in front of median ocellus.

Cleonymus brevis sp. n.
(Text-figs 5–9)

♀. Body mainly dark (though in places bright) green to bronzy, more or less with bright violaceous reflections on vertex posteriorly, on sides of pronotum, on mesoscutum in front of axillae, on propodeum (at least laterally), on dorsal and lateral sides of hind coxae and anteriorly on first tergite. Vertical part of frons bright cupreous. Antennal flagellum dark brown to black, scape, and also femora, tibiae and tarsi of legs bright red, but tibiae mostly infuscate, as well as tarsi apically. Fore wing (Text-fig. 6) with a broad brown infumation between base of parastigma and apical fifth of wing blade, interrupted partly by large hyaline macula anteriorly below marginal vein. Length 3–4·2 mm.

Head 1·1–1·14 times as broad as mesoscutum, in dorsal view 2·02–2·15 times as broad as long, with inner eye margins parallel; POL about 2·2–2·4 times the OOL. Head in facial view 1·37–1·38 times as broad as high. Frons between ocelli and the transverse blunt ridge (which is about 2·5 diameters from ocellus) fairly shiny, not very densely beset with piliferous punctures, interspaces generally broader than punctures but with an extremely fine broad-meshed engraved reticulation (alutaceous + puncturation = shagreening; Text-fig. 9). Subvertical part of frons angularly changing slope with the upper subhorizontal part (Text-fig. 7), densely transversely striate-reticulate; scrobes indistinct. Posterior part of vertex and occiput rugulose-reticulate. Relative measurements: head width 67, height 49, maximum distance between eyes 29, eye 34 : 29, malar space 19, mouth width about 28, scapus length 23, flagellum plus pedicellus combined 58. Pedicellus slightly longer than two following segments combined, these segments slightly transverse, subequal in length, the first narrower than the second; middle flagellar segments only very slightly transverse, seventh flagellar segment more transverse and slightly asymmetric, preclava with processus narrow but only slightly longer than body of the segment (Text-fig. 8).

Thorax dorsally (including propodeum) 1·7–1·8 times as long as broad, densely pubescent on pronotum and mesonotum, pubescence moderately long, mainly dark, but sometimes whitish on mid lobe of mesoscutum just in front of scutellum and in front of inner margins of lateral lobes. Sculpture mainly rugose-reticulate, more regularly reticulate on the disc. Mesoscutum 1·8 times to twice as broad as long. Propodeum in middle 0·43–0·45 the length of scutellum, with strong median carina which is about three times as long as the smooth convex dorsellum and only 0·35–0·38 the distance between inner edges of spiracles. Median part of propodeum, apart from the crenulate depressions, nearly smooth; groove formed by the flange posteriorly laterad of nucha in dorsal view not broader than the basal crenulate furrow. Metapleura rather densely hairy. Reticulate lower mesepimeron smaller than the nearly smooth upper part, the broad dividing depression in form of arched fovea reaching metapleural margin. *Fore wing* (Text-fig. 6) about 2·5 times as long as broad, hyaline in basal third and on the large spot below marginal vein; apex faintly infumate; otherwise with two brown cross-bands, one appended at parastigma, the other below postmarginal vein, the bands united on disc below white macula. Basal cell sparsely hairy below submarginal vein. Relative lengths in holotype; subcostal cell 72, marginal vein 34, postmarginal vein 34, stigmal vein 22, in two paratypes these measures 65 : 35 : 32 : 24 and 72 : 37 : 39 : 24, resp.

Gaster (Text-fig. 5) 1·8–1·97 times as long as broad and 1·23–1·27 times as broad as the mesoscutum, only 0·9–1·16 times as long as head plus thorax combined. Reticulation on basal halves of third and fourth tergite and on most of fifth tergite shallow, meshes mostly in form of transversely lengthened depressions; smooth belts at hind margins of tergites 5 and 6 with scattered raised piliferous punctures. Posterior margins of first, second and sixth tergites slightly produced, arcuate; fifth tergite 2–2·24 times as broad as long, in the middle always distinctly shorter than tergites 3 and 4 taken together. Hairs of gaster anteriorly whitish, posteriorly dark.

♂. Mainly black, with faint dark violaceous or dark green reflections on head and thorax, more brightly violaceous on propodeum, metapleurae and base of gaster. Antennae black; legs darker than in female, tibiae and tarsi blackish, also femora dorsally infuscate and usually

with a violaceous sheen. Fore wing slightly infumate, mostly with suffused brown clouds below parastigma and around stigmal vein. Head and thorax much as in female but sculpture relatively coarser, though in some places more superficial. The alutaceous meshes on frons deeper, frons therefore duller. Scrobes shallow but conspicuous. Antennae stouter than in female and *C. laticornis*; scapus three times as broad as long; pedicellus plus flagellum about twice as long as width of frons (49 : 25); pedicellus about 1·5 times as long as broad dorsally; first flagellar segment more anellus-like than in female, shorter and narrower than the second, which also has more adpressed pubescence like the rest of flagellum but unlike pedicellus and anellus; base of flagellum distinctly expanding below (in side view), the third segment the broadest, slightly asymmetric, slightly broader than the otherwise stoutly filiform flagellum; all funicle segments transverse, mostly about 1·5 times as broad as long, with the usual thick semi-erect pubescence. *Fore wing:* relative lengths of marginal, postmarginal and stigmal vein as 25 : 25 : 17 (allotype; in the other paratypes as 25 : 28 : 18 and 25 : 28 : 19, resp.). Gaster more densely hairy than in female, hardly narrower and slightly shorter than thorax, with petiole distinct, though fairly transverse, smooth and convex dorsally; fifth tergite about as long as two preceding tergites together. Length of body 3–3·2 mm.

VARIATION. Compared with the body the size of the eyes in females seems to vary considerably. Whilst in the holotype, breadth of the eye equals the distance between eyes, in one paratype of 3·7 mm body length, vertex breadth is 1·2 times the eye breadth, and in another paratype of only 3 mm length (a dwarf, reared in laboratory; wings still in pupal skin) the relation is 1·44 : 1. In the three males this relation varies between 1·14 and 1·18 to 1.

BIOLOGY. Parasite of xylophagous beetles; reared from *Hylesinus toranio* Bern. (Col., Scolytidae).

Holotype ♀. ITALY: Toscana, Sesto Fiorentino, vii.1943 (*L. Ceresa*), '*Cleonymus depressus* (F.) det. L. Masi'; now in BMNH.

Paratypes. CZECHOSLOVAKIA: Slovakia, Zádiel, ex *Hylesinus toranio*, 1 ♀, 1954 (*A. Pfeffer*); in Bouček Collection. FRANCE: Vienne, Isère, 3 ♂ (one of them allotype) (*L. Falcoz*); in MHN, Geneva, along with 1 ♀ without data from Coll. Chevrier. YUGOSLAVIA: Croatia, Krapina, 1 ♀ (*Hensch*); in ZIPF, Zagreb.

Before Graham's monograph this species was frequently mistaken for *Cleonymus obscurus* Walker and the Czechoslovak specimen was also recorded under that name by Bouček (1958 : 369).

Cleonymus laticornis Walker

Ichneumon depressus Fabricius, 1798 : 231. Type ♀, FRANCE: Paris (MNHN, Paris; or lost). [Nec Gmelin, 1790.]
Cleonymus laticornis Walker, 1837 : 351. Holotype ♂, IRELAND: Bexley (NM, Dublin).
?*Cleonymus obscurus* Walker, 1837 : 352. Lectotype ♂, BRITAIN: London (BMNH) [examined].

I have examined almost all the material of these two forms which Dr Graham had at his disposal and, thanks to several colleagues, extensive additional material of these rather rare insects. Special attention was paid to the variation and it was found that the relative length of malar space and the eye does not yield any reliable difference between *C. laticornis* and *C. obscurus* (used by Graham, 1969). In 33

females with body length ranging between 3·1–5·7 mm, the ratio between malar space and eye length varied mainly between 0·5 and 0·57 (in 27 ♀♀), not suggesting any gap or two-peak curve, but with two extreme deviations of 0·44 and 0·46, and another two of 0·65 and 0·66. The small figures do not correlate completely with the darker body colour, as assumed by Graham. In general, the figures obtained seem to suggest a trend in the eyes being relatively smaller in bigger specimens, which contrasts with what I found in *Cleonymus brevis* sp. n. The colour difference is notoriously unreliable with Pteromalid parasites of xylophagous beetles, but because the material of males, particularly of the darker form with hardly any wing markings (*obscurus*), is very scarce, I am leaving the question unresolved, although the study of the females suggests that only one species is involved.

For other references and information see Graham (1969 : 38, 39).

MATERIAL EXAMINED includes specimens from Britain, France, Switzerland, Czechoslovakia, Yugoslavia, Italy and Morocco (Tangier).

EUNOTINAE

EUNOTUS Walker

Eunotus Walker, 1834 : 297. Type-species: *Eunotus cretaceus* Walker, by monotypy.

Tridymus subgen. *Tritypus* Ratzeburg, 1852 : 227. Type-species: *Tridymus* (*Tritypus*) *areolatus* Ratzeburg, by monotypy.

Megapelte Förster, 1856 : 63, 66 [replacement name for *Eunotus* Walker, supposedly preoccupied].

Eunotus subgen. *Eunotellus* Masi, 1931 : 423. Type-species: *Eunotus* (*Eunotellus*) *aquisgranensis* Masi; designated by Graham, 1969.

For other references see Graham (1969).

The genus was divided by Masi (1931) in two subgenera, *Eunotus* s. str., with 5-segmented funicle in females, and *Eunotellus* Masi, with 4-segmented funicle in females. The males, however, do not yield any character in support and are difficult to separate even on specific level. Now another group has emerged, with *E. hofferi* sp. n. and *E. kocoureki* sp. n., distinguished by the relatively more flattened body with coarser and shallower sculpture, 3-toothed mandibles (Text-fig. 15) and different form of antennae in the males. Therefore, at least for the time being, it seems to me more appropriate to adopt species-groups rather than subgenera.

KEY TO EUROPEAN SPECIES

Females

1 Funicle 4-segmented.
Flagellum clavate; thoracic reticulation dense; scutellum transverse, 1·13–1·3 times as broad as long; fore wing pubescence very dense; marginal vein 1·34–1·63 times as long as the stigmal; first tergite smooth.
parvulus Masi (p. 287)
– Funicle 5-segmented 2

2 (1) First tergite distinctly reticulate, except near edges 3
– First tergite smooth 5

3 (2) Brachypterous (Text-fig. 25); thorax very flat dorsally, with wide-meshed reticulation, meshes with smooth bottom; scutellum nearly 1·4 times as broad as long; propodeum very short, only one-sixth the length of scutellum; antenna slender (Text-fig. 10), first funicle segment transverse, the second subquadrate, clava about 2·5 times as long as broad . . ***hofferi*** sp. n. (p. 277)

– Macropterous; the other characters not all present in combination . . . 4

4 (3) Scutellum distinctly though weakly convex, nearly as long as broad, very densely reticulate, dull; apex of scutellum bluntly angulate and reaching slightly beyond line with hind corners of propodeum; the latter medially extremely short. Sensilla linearia on flagellum very distinct; clava about three times as long as broad and usually darker than the mostly testaceous funicle. Marginal vein of fore wing 1·5–1·85 times as long as the stigmal, the latter bent, slightly longer than postmarginal vein and angle between them rather sharp, about 30°; apex of stigmal vein about half the length of this vein from front margin of wing. Eye round. Body bluish black . . ***cretaceus*** Walker (p. 281)

– Scutellum (Text-fig. 13) flat, almost 1·5 times as broad as long, rather coarsely reticulate, fairly shiny, its apex broadly rounded and not reaching the level of hind corners of propodeum; propodeum in the middle at least one-third as long as scutellum. Sensilla of flagellum indistinct, clava hardly more than twice as long as broad, its first segment transverse. Marginal vein fully 2·5 times as long as the stigmal, angle between short postmarginal vein and stigmal vein about 45°; apex of stigmal vein about two-thirds its length from front margin of wing. Eye longer than broad as 18 : 16. Body greenish black. . ***kocoureki*** sp. n (p. 279)

5 (2) Only first flagellar segment anellus-like, the second much bigger and subequal to third segment. Scutellum at least slightly (1·07–1·15 : 1) longer than broad (steep axillulae, if seen dorsally, not included), in the apical third its sides converging at about a right angle 6

– Basal two segments of flagellum anellus-like (Text-fig. 24), i.e., the second distinctly smaller than the third. Scutellum shorter than broad, usually broadly rounded apically 7

6 (5) Flagellum stout but hardly clavate (Text-fig. 18), its first segment narrower and hardly half as long as the second, which is almost as broad as the fifth; clava fully twice as long as broad, not distinctly asymmetric. Marginal vein less than twice (1·45–1·85 times) the length of stigmal vein (Text-fig. 17). POL to OOL as about 2·8 : 1; occipital ridge often blunt, at least laterad of posterior ocelli. Body often about 2 mm . . . . ***areolatus*** (Ratzeburg) (p. 282)

– Flagellum strongly clavate, gradually broadening towards clava, the latter hardly 1·5 times as long as broad, asymmetric, subtrunctate at apex. Marginal vein clearly more than twice as long as the stigmal (Text-fig. 20). POL to OOL about 4 : 1; occipital ridge very sharp, even laterally. Body at most 1·8 mm . . . . ***obscurus*** Masi (p. 284)

7 (5) Thoracic dorsum dull, densely ruguloso-reticulate. Antennal clava long-ovate, moderately stout, not distinctly asymmetric (Text-fig. 22). ***acutus*** Kurdjumov (p. 285)

– Thoracic dorsum moderately shiny, as the sculpture is more superficial. Antenna more strongly clavate (Text-fig. 24), often asymmetric, subtruncate ventro-apically 8

8 (7) Angle between stigmal and postmarginal vein very sharp, usually about 30°; space between the two veins at least twice as long as broad, postmarginal vein at least 2/3 the marginal vein. Antennal clava fuscous, distal funicle segments yellowish. OOL 1·3–1·5 the diameter of lateral ocellus. 1·2–1·4 mm . . . . ***nigriclavis*** (Förster) (p. 286)

Angle between stigmal and postmarginal vein broad, about 60°; space between the two veins about as long as broad, postmarginal vein half the marginal. Antennal clava and funicle unicolorous, yellow. OOL subequal to maximum diameter of lateral ocellus. 1·1 mm . . . . . ***merceti*** Masi (p. 286)

Males

1 Antennae relatively long, flagellum plus pedicellus combined at least 1·2 times the width of head; first funicle segment at least slightly shorter than the fourth, the latter aways distinctly elongate, in length subequal to the first claval segment (Text-figs 11, 14); third claval segment shorter than the first; flagellum with strong and high sensillar ridges, these uninterrupted on the whole length of the segment, 4–5 of them visible in any lateral view. Body rather flattened; reticulation on thorax wide-meshed; median carina of propodeum not distinctly raised anteriorly. Mandibles 3-toothed (Text-fig. 15) 2

. Antennae relatively shorter, flagellum plus pedicellus combined at most 1·1 times the head width; first funicle segment usually longer than the fourth which, if elongate, is distinctly longer than the first claval segment (Text-fig. 16); the latter much shorter than the third claval segment which bears two rows of sensilla; flagellar longitudinal sensilla much finer and shorter, but more numerous, forming at least on some of the basal segments two or three irregular rows, i.e., they are not united to form strong regular ridges along the whole segment as above. Body not unusually flattened; reticulation on thorax usually dense; median carina of propodeum raised anteriorly to form a distinct tooth. Mandibles 2-toothed. 3

2 (1) Body length 0·6–0·7 mm; basal tergite of gaster smooth; venation of fore wing pale brown . . . . ***hofferi*** sp. n. (p. 277)

. Body 1·0–1·3 mm; first tergite on disc extensively coarsely engraved-reticulate (as Text-fig. 13); venation of fore wing dark brown . ***kocoureki*** sp. n. (p. 279)

3 (1) First tergite mainly longitudinally reticulate, smooth only near the edges; tibiae extensively testaceous; body 0·85–1·2 mm . . ***cretaceus*** Walker (p. 281)

– First tergite smooth all over; tibae and length otherwise 4

4 (3) Scutellum distinctly longer than broad (measured between axillular furrows), its margins posteriorly converging at about 90° or a slightly sharper angle. Inner angle of axilla 60° or more. Postmarginal vein usually longer than the stigmal. Body usually at least 1·2 mm in length 5

– Scutellum shorter, at most as long as broad but usually slightly transverse, posteriorly rounded or, if sides converging, the angle is more than 90°. Inner angle of axilla distinctly less than 60°. Postmarginal vein often shorter than or as long as the stigmal. Body often less than 1·2 mm 6

5 (4) Marginal vein about 2·5 times as long as the stigmal. Body small. (According to Masi, 1931) . . . . ***obscurus*** Masi (p. 284)

– Marginal vein about 1·7–1·8 times as long as the stigmal. Body often relatively larger, up to 2 mm, but small specimens of 1 mm are also known. ***areolatus*** (Ratzeburg) (p. 282)

6 (4) Angle between postmarginal and stigmal vein very small, about 30°; stigmal vein often only hardly shorter than the marginal. Body 0·75–0·95 mm. Flagellum brownish, combined with pedicellus often shorter than width of head; distal funicle segments subquadrate, constrictions between segments very conspicuous; pedicellus not much narrower than and distinctly more than half as long as the first funicle segment . ***nigriclavis*** (Förster) (p. 286)

– Angle between postmarginal and stigmal vein broader, usually about 45° or more; stigmal vein distinctly shorter than the marginal. Body longer than 0·85 mm. Flagellum mostly blackish, its length with pedicellus usually distinctly more than width of head; funicle more compact, constrictions between segments usually hardly conspicuous, distal funicle segments elongate, the first distinctly broader and usually about twice as long as pedicellus 7

7 (6) Eye relatively larger (Text-fig. 26), 1.02–1.16 times as high as broad, maximum height 1·2–1·4 times the malar space. Mid and hind tarsi, sometimes also tibiae, extensively testaceous. Wing pubescence very dense. ***parvulus*** Masi (p. 287)

– Eye relatively smaller (Text-fig. 23), about as high as broad or slightly broader, its maximum height about 1·1 times the malar space. Mid and hind tarsi testaceous only basally, tibiae mostly fuscous. Wing pubescence generally less dense than above . . . . . . ***acutus*** Kurdjumov (p. 285)

Note: The male of *E. merceti* Masi is not known.

THE *KOCOUREKI*-GROUP

Eunotus hofferi sp. n.
(Text-figs 10–12, 25)

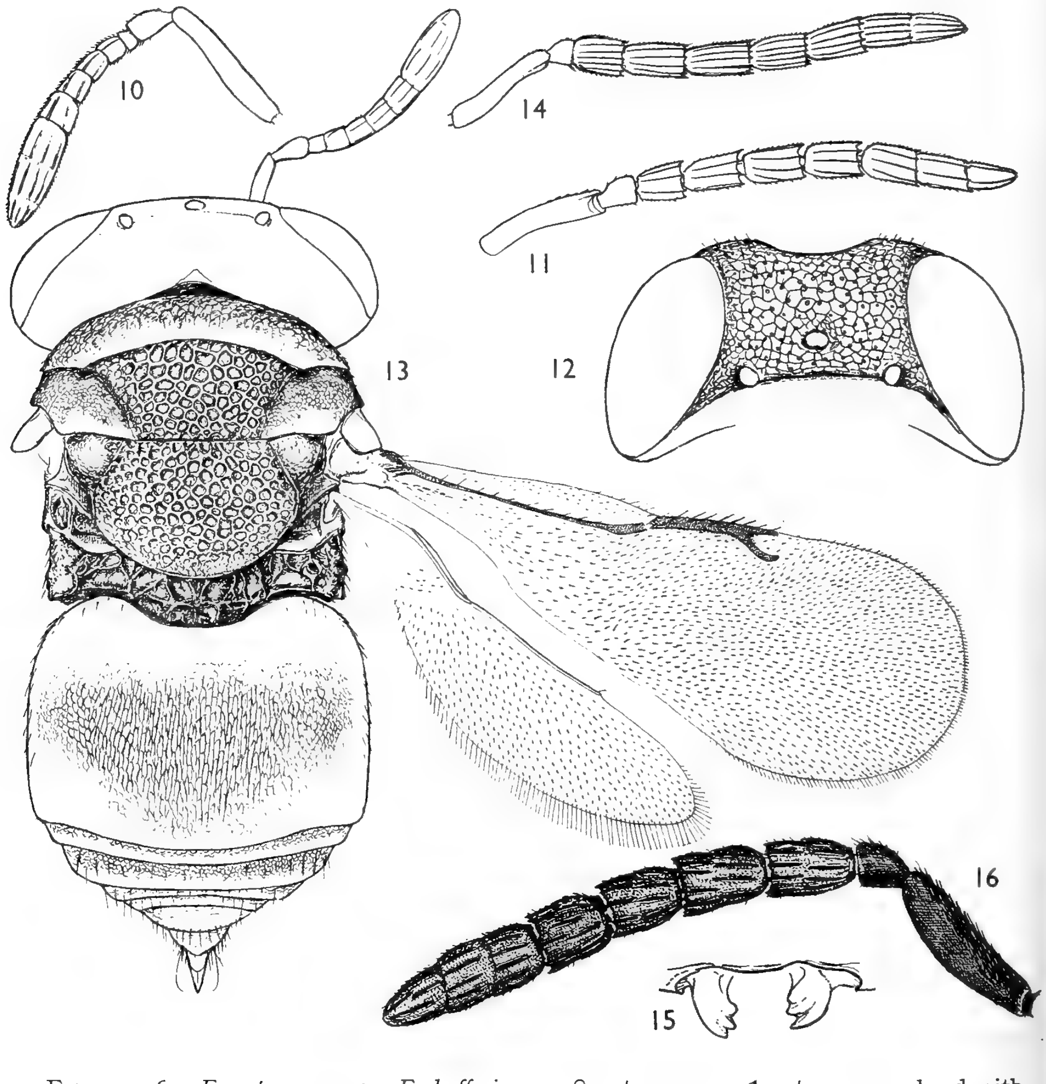
♀. Body black, in places with a faint dark green or bluish green tint. Antennae mainly testaceous but scapus infuscate except for narrowly pale apex; pedicellus also infuscate. Legs concolorous with body, tarsi testaceous except apical segment. Wing rudiments infumate. Length 1·1 mm.

Head (Text-figs 12, 25) nearly 1·2 times as broad as mesoscutum, rather stout, only 1·9 times as broad as long (in dorsal view along bottom of scrobes). POL about 6 times the OOL, which is hardly more than one ocellus diameter; median ocellus distinctly in front of line through front edges of lateral ocelli, the ocellar triangle 2·6 times as broad as high. Upper frons 0·43 breadth of head, rather shiny, engraved-reticulate, almost every mesh of reticulation with a small excentric piliferous puncture (Text-fig. 12). Lower frons with reticulation denser and less regular, distinctly raised on fairly concave scrobes. Eye very large, slightly higher than broad (16 : 14·5), without conspicuous pubescence. Other relative measurements: width of head 31·5, height 23, width of frons 13·7, malar space hardly 10, width of mouth about 9 (broadening posteriorly), length of scapus 11·3, flagellum plus pedicellus 21·5, i.e., about two-thirds width of head. Scapus weakly sinuate, feebly thickened in basal half; pedicellus dorsally about 1·5 times as long as broad, first flagellar segment anelliform (Text-fig. 10), narrower than the second, about 0·6 times as long as broad; second flagellar segment hardly narrower than the third but slightly transverse, the following three segments slightly increasing in width and all subquadrate; clava bluntly lanceolate, distinctly broader than preceding segment, about as long as the four preceding segments combined. Flagellum moderately clavate (in terms within the genus), with sparse longitudinal sensilla which are as long as the segments but absent from ventral side of clava (as usual in the genus; this has caused some authors to regard clava sometimes as indistinctly segmented when examined from ventral side).

Thorax flattened above, slightly shorter than long dorsally. Pronotum medially about three-fifths the length of mesoscutum, its posterior half nearly smooth. Mid lobe of mesoscutum nearly 2·5 times as broad as long, notauli strongly diverging forward; mid lobe as well as scutellum with broad-meshed shallow, but raised, reticulation. Scutellum lateroposteriorly

more finely reticulate-punctulate, itself 1·5 times as broad as long; axillar furrows strongly converging but reaching mesoscutum well outside of notauli. Metanotum indistinct. Propodeum extremely short, about one-sixth the length of scutellum, costula not distinct, median carina very short but raised. Pleural parts of thorax reticulate. Legs relatively strong, femora moderately thickened. *Wings* rudimentary; fore wing triangular, obliquely truncate, reaching just over base of gaster (Text-fig. 25).

Gaster slightly shorter than head plus thorax combined, strongly convex. First tergite about 1·3 times as broad as long, distinctly longitudinally engraved-reticulate, sculpture fine and becoming obliterated towards the smooth hind margin; the latter hardly produced; epipleurae of first tergite with the same sculpture as its dorsum.



FIGS 10–16. *Eunotus*. 10–12. *E. hofferi*. 10, ♀ antenna; 11, ♂ antenna; 12, head with sculpture on frontovertex. 13–15, *E. kocoureki*. 13, ♂, infumation of fore wing and sculpture of head not indicated; 14, ♂ antenna; 15, mandibles. 16, *E. acutus*, ♂ antenna.

♂. Body colour as in female. Antennae and legs brownish black, tarsi paler brown towards base. Wings fully developed, subhyaline. Length about 0·7 mm. Head fully 1·2 times as broad as mesoscutum. Relative measurements: width of head 25·5, length 12, height 19, frons width 14, eye 10 : 10, malar space 9, scapus 10, flagellum plus pedicellus 32. Pedicellus dorsally slightly elongate, about three-fifths of first funicle segment. All flagellar segments elongate (Text-fig. 11), the first slightly shorter than the second or fourth, the latter subequal to first claval segment; third claval segment the smallest, narrow, subacuminate. Flagellum with coarse ridge-like sensilla which extend beyond apex of the segments as distinct teeth, in lateral view about 5 ridges visible on each segment. Thorax as usual in alate forms of genus, 1·25 times as long as mesoscutum broad, dorsally more convex than in female, fairly shiny due to wide-meshed raised, but shallow, reticulation. Pronotum rather convex, its hind margin broadly emarginate, therefore in middle only half as long as mesoscutum; mid lobe of the latter about 1·7 times as broad as long. Scutellum 0·95 times as long as broad. Propodeum moderately sloping, in middle about 0·4 the length of scutellum and here distinctly produced beyond sublateral parts; costula irregular, less distinct than the weak median carina and the indicated plicae. *Fore wing* rather regularly and fairly densely pubescent. Relative measurements: wing length 50, width 22·5, costal cell length 17, marginal vein 8, postmarginal 3·5, stigmal vein 3·2 (in another specimen last three figures 7 : 3 : 3). First tergite 1·3 times as broad as long, dorsally smooth, but epipleurae (ventral sides of tergites) with some wide-meshed alutaceous reticulation as in female, but weaker.

Apart from the antennal characters and the 3-toothed mandibles, which suggest close relationship with *E. kocoureki* sp. n., *E. hofferi* differs from *E. parvulus* Masi and *E. acutus* Kurdjumov by its much shinier thorax.

BIOLOGY. Host not known; all specimens collected on xerothermic grassland slopes, on limestone, sand or loess.

Holotype ♀. CZECHOSLOVAKIA: S. Moravia, Dolní Věstonice, 4.vii.1952 (*Hoffer*); in BMNH.

Paratypes. CZECHOSLOVAKIA: Bohemia, Praha-Chuchle, 1 ♂, allotype, 11.vii.1955 (*Bouček*); S. Moravia, Dolní Věstonice, 1 ♂, 24.v.1954 (*Hoffer*); SE. Slovakia, Piliš Hill nr Slov. Nové Mesto, 2 ♂, 3. and 13.vii.1950 (*Hoffer*); Královský Chl'mec, 1 ♂, 20.v.1958 (*Bouček*); paratypes partly in NM, Prague, partly in Bouček Collection.

The species is named in honour of Dr A. Hoffer, of Prague, a prominent Czech hymenopterist.

Eunotus kocoureki sp. n.

(Text-figs 13–15)

♀. Black, with faint dark green tint mainly on head and thorax. Antennae dark testaceous, with pedicel infuscate and scapes also slightly infuscate in basal halves. Legs concolorous with body, fore basitarsus basally and mid and hind tarsi except the claw segment dark testaceous. Fore wing infumate but paler basally at hind margin and in apical third; venation dark brown. Length 1·4 mm.

Head broader than mesoscutum as 41 : 35, in dorsal view 2·2 times as broad as long, strongly crescentic, with occiput strongly excavated, but dorsal ridge not sharp. POL to OOL about as 4 : 1, OOL itself equals about 1·4 diameter of ocellus; line drawn through front edges of lateral ocelli intersecting hind quarter of median ocellus, ocellar triangle about 3·8 times as broad as

high. Upper frons in front of ocelli nearly half (0·47) as broad as head, rather dull, with conspicuous engraved reticulation, each mesh bearing a piliferous puncture which takes up at least half of mesh surface. Lower frons with very dense raised reticulation, this denser in the middle, the very shallow scrobes therefore still duller; sublaterally reticulation less dense and less regular, at orbits and on genae again very dense. Relative measurements: head width 41, height 27, frons width 19·5, eye 15 : 17·5, malar space 13, mouth width about 11. Eye pubescence sparse, short, inconspicuous. Both mandibles 3-toothed. Relative length of scape 15, flagellum plus pedicellus 27, i.e., slightly less than width of head less one eye. Scapus slender, distinctly sinuate, scarcely thicker in basal half; pedicellus dorsally nearly twice as long as broad (Text-fig. 13); flagellum slender, weakly clavate, its first segment shorter but not abruptly narrower than the second and still slightly longer than broad; longitudinal sensilla of flagellum sparse, long, 1–2 in a view on second and third segment and 3 on fourth and fifth segment; clava hardly longer than three preceding segments combined, long-oval, nearly three times as long as broad, with three rows of sparse sensilla, its first segment slightly longer than the preclaval one and distinctly longer than the third claval segment.

Thorax dorsally flattened, broad (Text-fig. 13), from anterior edge of collar down to apex of propodeum only as long as breadth of mesoscutum. Pronotum dorsally 0·45 the length of mesoscutum, laterally narrowed, without shoulders; front half of collar finely rugulose-reticulate, hind half nearly smooth, shiny; lateral panel of pronotum above with deep depression delimited by a horizontal crest opposite to lower edge of the small prepectus. Mid lobe of mesoscutum twice as broad as long, together with scutellum coarsely and rather deeply reticulate-punctured; side lobes and axillae finely sculptured, partly smooth at cross-suture. Scutellum 1·45 times as broad as long, apically broadly rounded, apical quarter much more finely and superficially sculptured than the disc; axillar furrow reaching mesoscutum just outside notaulices; axillulae not distinct. Metanotum visible only laterally. Propodeum subhorizontal, medially slightly more than one-third the length of scutellum; median carina low, rather broad, weakly raised before middle; costula rather indistinct, crossing the mainly longitudinal rugae; spiracle oval, open; hairs of callus short, not conspicuous. Thoracic pleurae dull, rather deeply reticulate, except below the wings where sculpture forms longitudinal striae; mesepimeron without central pit; metapleura and lower part of lateral panel of propodeum slightly shiny. *Fore wing* fully developed, about 2·6 times as long as broad; its hind margin with distinct lobe beyond basal quarter; front margin shallowly emarginate at end of costal cell. Relative measurements: length of costal cell 27, marginal vein 10, postmarginal vein 3·5, stigmal vein 4. Wing disc with dense but extremely short hairs, in basal two-fifths hairs much longer and rather sparse.

Gaster with slightly protruding ovipositor sheaths as long as head plus thorax combined (Text-fig. 13). First tergite 1·3 times as broad as long, its hind margin produced slightly arcuately, dorsal and epipleural surface distinctly longitudinally striate-reticulate, but smooth basally and near edges, more broadly so in hind corners.

♂. Differs from female as follows. Antennae mostly black, scapus sometimes dark testaceous at both ends or only distally. Apex of mid and hind tibiae shortly testaceous. Fore wing subhyaline, mostly only with slight infumation forming an angulate streak below parastigma along basal and cubital folds. Length 1·0–1·2 mm. Head more regularly reticulate-punctured, frons above duller, reticulation raised. In dorsal view temples visible though strongly receding. Eyes relatively smaller; their relative measures 12 : 13, width of frons 19·5, malar space 12, mouth width 10, scapus 13 (nearly as slender and sinuate as in female), flagellum plus pedicellus combined 44, i.e., four-thirds the head width. Pedicellus subglobular, about half as long as first funicle segment. All flagellar segments (Text-fig. 14) with high coarse sensillar ridges along the whole lengths which project like teeth beyond apex of each segment; groove-like bottoms slightly shiny, with short regular semi-erect hairs. Flagellum slightly tapering towards apex, fourth segment about 1·7 times as long as broad, slightly longer than the first but hardly longer than the following first claval segment; third claval segment the smallest, distinctly shorter than any other flagellar segment. Scutellum regularly reticulate-punctured all over. Gaster hardly half as long as head plus thorax together, first tergite distinctly longitudinally engraved-reticulate.

BIOLOGY unknown. Collected on xerothermic grassland.

Holotype ♀. BULGARIA: Sandanski, vi.1969 (*Kocourek*); in BMNH.

Paratypes. BULGARIA: Sandanski, 4 ♂ (including allotype) (*Kocourek*); Bouček Collection.

Named in honour of Ing. M. Kocourek, a Czech hymenopterist and very good collector.

Eunotus hofferi and *E. kocoureki* form a very distinctive species-group. Unlike the other species of the genus they have 3-toothed mandibles (Text-fig. 15), in males the longitudinal sensilla of the flagellum are very strong, ridge-like and extend along the whole segment and the segments of the funicle and clava are subequal, as stressed in the key. The females, apart from the rather depressed thorax with the scutellum very short and transverse, have a peculiar depression on the upper part of the lateral panel of the pronotum; this fovea is present though less conspicuous, in the males. Both species seem to be associated with xerothermic habitats although nothing is yet known about their hosts.

THE *CRETACEUS*-GROUP

Eunotus cretaceus Walker, although rather distinctive, seems to be more related to *E. areolatus* and *E. obscurus* Masi than to the above group or the *acutus*-group.

Eunotus cretaceus Walker

Eunotus cretaceus Walker, 1834 : 298. Lectotype ♀, BRITAIN: Isle of Wight (BMNH) [examined].

Eunotus festucae Masi, 1928 : 128. Syntypes ♂♂, ♀♀, ITALY: San Vito near Modena, ex *Eriopeltis festucae* (Fonscolombe) (MCSN, Genoa and BMNH) [examined].

For comments on the type-material and synonymy see Masi (1931) and Graham (1969). I have seen Masi's material in Genoa but at that time (1965) I did not select the lectotype.

BIOLOGY. *E. cretaceus* develops as predator on the eggs (probably all species of the genus develop in a similar way) of the following Coccids on grasses: *Eriopeltis festucae* (Fonscolombe) (e.g., Masi, 1928 and 1931), *E. agropyri* Borchsenius (n. rec.), *E. ?strelkovi* Borchsenius (Graham, 1969), *Eriopeltis* sp. (n. rec.), *Scythia* (=*Mohelnia*) *festuceti* (Šulc) (n. rec.).

DISTRIBUTION. Europe, from Britain and southern Sweden to southern Italy and to the U.S.S.R. (Moldavian S.S.R. and Georgia).

MATERIAL EXAMINED.

Type-data given in synonymy.

BRITAIN: Surrey, White Downs near Dorking, 1 ♂, 5.vii.1964, 1 ♂, 20.vi.1970 (*Bouček*); Warwickshire, Stratford-on-Avon, ex *Eriopeltis festucae*, 4 ♀, 4 ♂, 16.viii. 1965 (*R. E. Evans*), BMNH. SWEDEN: Skåne, Kivik, ex *E. festucae*, 4 ♀, 1 ♂, viii. 1938, and Löderup, 1 ♂, 22.vii.1938 (*D. M. S. & J. F. Perkins*), BMNH. GERMANY: 'Deutschland', 1 ♀ (*Erichson*), MNHU, Berlin, identified as *E. festucae* by Masi. CZECHOSLOVAKIA: Bohemia, Milá, Středohoří Mts, 1 ♂, 5.vii.1956 (*Bouček*); Praha-Hanspaulka, ex *Eriopeltis festucae*, 14 ♀, 3 ♂, about 1945 (*B. Starý*); Praha-Košíře, 1 ♂, 1.vi.1947 (*Bouček*); Malá Skála near Turnov, 1 ♀, 1942 (*Obenberger*), NM, Prague; Nové Město nad Metují, 1 ♀, vii.1961 (*J. Macek*); Moravia, Mohelno, 2 ♀, 6.vii.1957 (*Bouček*); Slovakia, Kováčov near Štúrovo, ex *Scythia festuceti*, 6 ♀, 1 ♂, 1960 (*Hoffer*); Mt Revaň, 1200 m, 1 ♀, 5.ix.1956 (*J. Brtek*). U.S.S.R., MOLDAVIAN S.S.R.: Slobodzeia, ex *Eriopeltis agropyri*, 4 ♀, viii.1960 (*Talitzki*). GEORGIA: Tbilisi district, ex *Eriopeltis* sp., 1 ♀, 3 ♂, vi.1957 (*Hoffer*).

Eunotus areolatus (Ratzeburg)

(Text-figs 17–19)

Tridymus (*Tritypus*) *areolatus* Ratzeburg, 1852 : 227, 2 figs. Type ♀, W. GERMANY: Hohenheim [lost].

[*Enargopelte obscurus* (!) Förster; Kryger, 1943 : 79–81, figs 5, 6. Misidentification.]

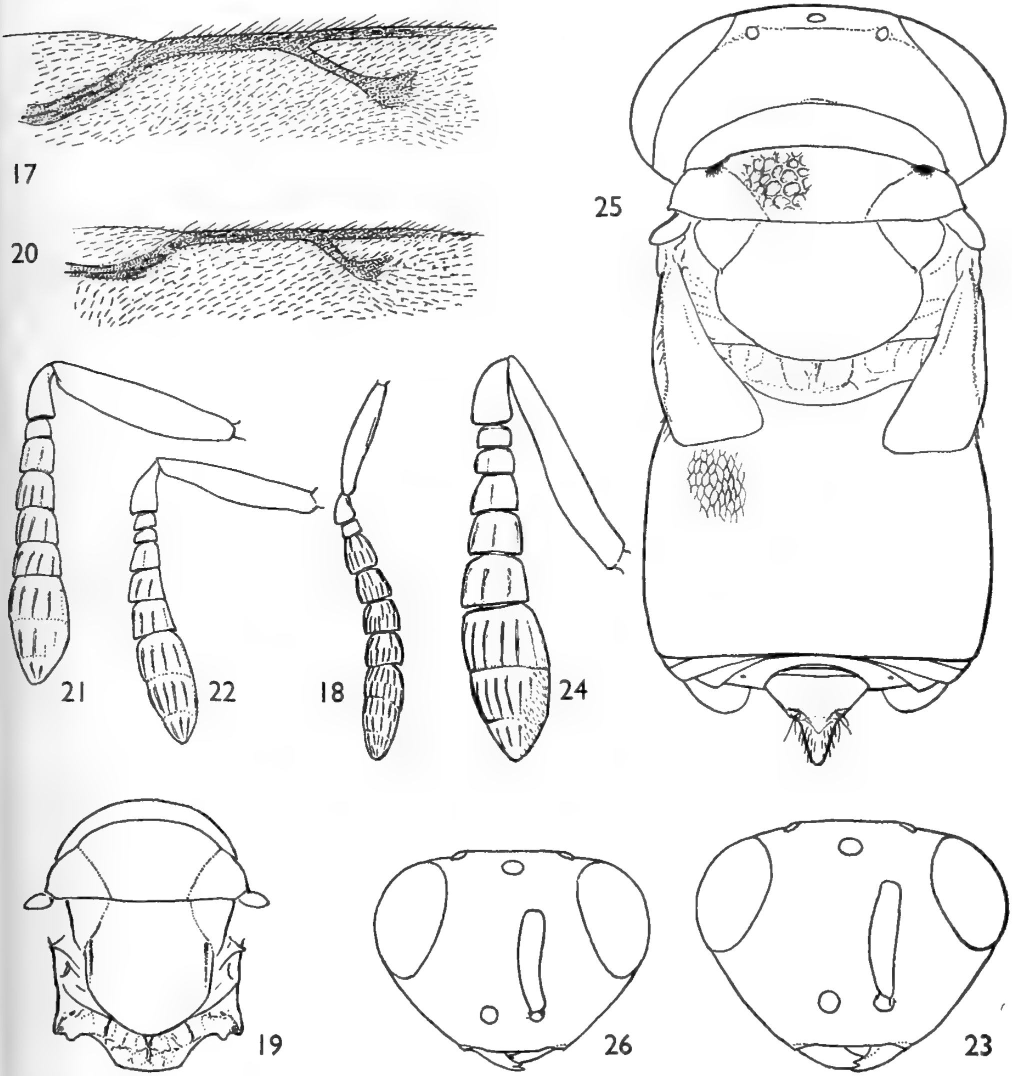
Eunotus subcyaneus Erdös, 1953 : 222–223, fig. 1. Holotype ♀, HUNGARY: Kelebia [TM, Budapest) [examined]. **Syn. n.**

?*Eunotus antshar* Nikolskaya *in* Nikolskaya & Kyao, 1954 : 413–414, figs 5a–d. LECTOTYPE ♀, U.S.S.R.: W. Kazakhstan, Yanvartsevo (ZI, Leningrad), here designated [examined].

This is the only species known to me which has the scutellum elongate and, in the female, the antenna with one anellus only and the flagellum rather stout, not much attenuate towards the base. Both these characters are seen in Ratzeburg's figure. This author also described the propodeum as having a median areola (on the basis of which he erected the subgenus *Tritypus*). As a matter of fact the areola is not developed in any *Eunotus*. But in the present species the median part of the propodeum protrudes posteriorly more than in any other species and being separated from the sublateral parts by a distinct costula, it may, in some lights and at lower magnification, and when seen slightly from behind, suggest a presence of a median area (Text-fig. 19). In such a view the median carina often becomes obsolete, while the costula is distinct, in middle angulate forward. *E. areolatus* is also the largest known species in Europe and this again fits Ratzeburg's statement of 2‴. He received his specimens from a '*Coccus*' on *Salix aurita* in south-western Germany. This suggests a host not associated with warm places and indeed, most material at hand comes from moister and colder habitats.

I have seen also Kryger's material from Denmark kindly made available by Mr Bakkendorf and the type of *E. subcyaneus* Erdös on which the first vital information was supplied by Prof. Szelényi, who later kindly submitted the type itself. I have little doubt that *E. antshar* also is the same. Its lectotype female, kindly

submitted by Dr Trjapitzin, differs from the two females of *areolatus* presently at my disposal in having the antennal scape slightly stouter (3·4 : 1), the malar space slightly shorter than eye (25 : 28; in *areolatus* from Sweden 30 : 29 and 25 : 25, resp.), and the propodeal basal tooth in lateral view slender and jutting out towards the scutellum. These differences are small but may prove eventually to be constant, when more is known.



FIGS 17–26. *Eunotus*. 17–19. *E. areolatus*. 17, fore wing venation in ♀; 18, ♀ antenna; 19, thorax. 20–21. *E. obscurus*. 20, fore wing venation in ♀; 21, ♀ antenna. 22–23. *E. acutus*. 22, ♀ antenna; 23, ♂ head in facial view. 24, *E. nigriclavis*, ♀ antenna. 25, *E. hofferi*, body of ♀. 26, *E. parvulus*, head of ♂ in facial view.

BIOLOGY. Ratzeburg (1852) obtained his *E. areolatus* from a '*Coccus*' on *Salix aurita*, Kryger (1943) collected it on *Salix repens*, Erdös (1953) on *Pinus nigra*. *Eunotus antshar* was reared from *Rhodococcus spiraeae* (Borchsenius) (Nikolskaya & Kyao, 1954). The species, in common with the following *E. obscurus*, seems to be associated with Coccids on trees and bushes, not on grasses.

DISTRIBUTION. Sweden, Denmark, W. Germany, Czechoslovakia, Hungary; ?U.S.S.R. (W. Kazakhstan).

MATERIAL EXAMINED.
Type-data of *E. subcyaneus* and of *E. antshar* given in synonymy.

SWEDEN: Upland, Vallentuna, 1 ♂, 1 ♀, 17.iv.1960 (*K. J. Hedqvist*); Skåne, Höör district, 1 ♀, 11.vi.1938 (*D. M. S. & J. F. Perkins*), BMNH. DENMARK: N. Sealand, Lyngby nr Copenhagen, 1 ♂, 9.vi.1962 (*Bakkendorf*); Sandkroen, 1 ♂, 26.v.1931 (*Kryger*), UZM, Copenhagen. CZECHOSLOVAKIA: Bohemia; Jedlová near Rumburk, 1 ♂, 29.vi.1957 (*Bouček*); Moravia, Hodice near Jihlava, 3 ♂, 7.vi.1953 (*F. Kodys*).

Eunotus obscurus Masi

[*Eunotus cretaceus* Walker; Masi, 1907 : 262–266, figs 23, 24. Misidentification.]
Eunotus obscurus Masi, 1931 : 424, 428–430, fig. 1a. Syntypes ♀♀ and 1 ♂, FRANCE (MHN, Paris), GERMANY (NM, Vienna), ITALY: Bevagna (MCSN, Genoa) and SPAIN (IEE, Madrid) [mostly examined].
[*Eunotus cretaceus* Walker; Kryger, 1943 : 75–78, figs 3, 4. Misidentification.]

I have seen most of the syntypes of *E. obscurus* and compared them with my specimens, but at that time (1965, 1966) did not select the lectotype. Kryger's material was also examined. The latter author (1943) mentions having reared 35 females but no male. Neither have I seen any male in spite of having had more varied material. The only male known is the one recorded by Masi (1931) from Spain. *Eunotus obscurus* may be parthenogenetic, at least in northern and central Europe. Even the description of the Spanish male, judging from the unusually long marginal vein, may concern the closely related *Eunotus areolatus* (Ratzeburg).

BIOLOGY. The parasite attacks Coccids on various bushes and trees, mainly *Pulvinaria vitis* (L.) (=*betulae* L.) (Masi, 1931 and n. rec.; probably also '*Coccus* on *Salix repens*' concerns this species; Kryger, 1943). Another record is *Parthenolecanium persicae* (F.) on *Robinia pseudacacia* L. (Masi, 1931).

DISTRIBUTION. Denmark, W. Germany, France, Spain, Italy, Czechoslovakia, U.S.S.R. (Moldavian S.S.R. and ?Uzbekistan).

MATERIAL EXAMINED.
Type-data given in synonymy.

DENMARK: N. Sealand, Sandkroen, ex *Coccus* on *Salix repens*, 4 ♀, coll. vi.1929, em. v.1930 (*Kryger*). CZECHOSLOVAKIA: E. Slovakia, Košice, 1 ♀, 31.v.1952 (*Kocourek*). U.S.S.R., MOLDAVIAN S.S.R.: Dubossary, ex *Pulvinaria betulae* on

Crataegus, 4 ♀, 2.vi.1964 (*Talitzki*); Kishinev, ex *Pulvinaria betulae*, 8 ♀, 1.vi.1964 (*Talitzki*). U.S.S.R., ?UZBEKISTAN: Agashik, ex *Pulvinaria betulae*, 4 ♀, 9.viii.1928 (*Archangelskaja*), in ZI, Leningrad.

THE *ACUTUS*-GROUP

Eunotus acutus Kurdjumov
(Text-figs 16, 22–23)

Eunotus acutus Kurdjumov, 1912 : 330–331, figs 1A–D, 3A–B. LECTOTYPE ♀, UKRAINIAN S.S.R.: Poltava (ZI, Leningrad), here designated [examined].

According to a personal statement by the late M. N. Nikolskaja, all that was left of the Kurdjumov collection at the Experimental Station in Poltava, where he worked, was transferred to the Zoological Institute in Leningrad about 40 years ago. The only type-material of *E. acutus* consists of two specimens. One syntype is in bad condition (most of thorax only left) and labelled '13/46'; the other one, a female in good condition, is selected here as lectotype. It is labelled '13/45' and, probably in Kurdjumov's handwriting, '*Eunotus acutiventris* Kurdj.'. He probably changed the name in the manuscript, as may be guessed also from the apparent derivation of the name from the gaster which he described in the key as 'acute angled at the tip'. It fits the description well and agrees exactly with one of the smallest specimens from Bohemia. The body-size varies in females from 1–1·5 mm, in males 0·85–1·2 mm.

The females can be recognized rather easily on the characters given in the key above, but the males are very similar to those of *E. parvulus* Masi and, to some extent, also to *E. nigriclavis* (Förster). In the former two species I have found also a rather wide range of variation and the rather slight differences mentioned in the key above proved only more or less reliable. The figures obtained by careful measurement often overlap. For example, among more than 20 males of *E. acutus* (reared with the females) the ratio of the breadth of the frons and the breadth of the eye is 1·34–1·5 : 1, whilst in 18 males of *E. parvulus* (mostly British and North European specimens) it is 1·08–1·35 : 1. Otherwise in *E. parvulus* the vestitute of the eyes seems to be generally longer, more conspicuous. I have not found any good character in the relative lengths of the fore wing veins, in scutellum (which seems, however, to be relatively broader in *E. parvulus*), or in propodeum, thoracic pleurae, etc. In some males of *E. parvulus* the scapus is more attenuate distally, but in some others it is not. In both species the thoracic dorsum is rather dull. In the females of *E. nigriclavis* it is shinier, and the scutellum is slightly more convex.

BIOLOGY. The records from the fresh material together with information published earlier list the following Coccids as hosts: *Acanthococcus greeni* (Newstead) (Kurdjumov, 1912), *Rhizococcus agropyri* Borchsenius (n. rec.) and *Greenisca placida*

(Green) (n. rec.). The parasite seems to be closely associated with grasses, mainly with *Agropyrum* species in xerothermic habitats.

DISTRIBUTION. Poland, Czechoslovakia, Ukrainian S.S.R.

MATERIAL EXAMINED.
Type-data given in synonymy.

POLAND: Poznań-Bebice, ex *Rhizococcus agropyri* on 'low grass', 5 ♀, 1 ♂, vii.–xi. 1967 (*Lewandowski*). CZECHOSLOVAKIA: Bohemia, Hazmburk Hill near Libochovice, 1 ♀, 2.vi.1943 (*Hoffer*); Praha-Ruzyně, 1 ♀, 22.v.1953 (*Bouček*); Karlštejn, ex *Greenisca ?placida*, 60 ♀, 34 ♂, 1957–58 (*Hoffer*); Prachatice, 1 ♀, 30.viii.1950 (*Hoffer*); Moravia, Hostýn, ex *Greenisca placida*, 5 ♀, 1 ♂, 1957 (*P. Starý*).

Eunotus nigriclavis (Förster)

Megapelte nigriclavis Förster, 1856 : 66. Holotype ♀, GERMANY: Aachen (NM, Vienna) [examined].

The material mentioned below has been compared with the type of *E. nigriclavis* in Vienna. The form of the antennal clava does not seem to be such a good character as Masi thought. Although in this and the following species the clava is usually stouter than in any other species, in all species it has the ventral side deprived of longitudinal sensilla in place of the extended area of micropilosity and, in *E. nigriclavis*, appears usually slightly obliquely truncate in dry specimens.

BIOLOGY. Host not known. In central Europe *E. nigriclavis* occurs mainly in woods and montane regions.

DISTRIBUTION. Germany (West), Czechoslovakia, Yugoslavia.

MATERIAL EXAMINED.
Type-data given in synonymy.

CZECHOSLOVAKIA: Bohemia, Krkonoše Mts, Černá Hora, 1200 m, 1 ♀, ix.1949 (*Hoffer*); Nový Hradec Králové, 250 m, 1 ♀, 6.viii.1958 (*Bouček*); Hůrka v Pošumaví, 1 ♀, 17.vii.1954 (*Hoffer*); Šumava Mts, Horní Sněžná, 1000 m, 1 ♂, 15.vii.1946 (*Hoffer*); Moravia, Javořice, 800 m, 1 ♀, 7.viii.1944 (*Hoffer*). YUGOSLAVIA: Dalmatia, Biograd na moru, 1 ♂, 14.vii.1968 (*Bouček*).

Eunotus merceti Masi

Eunotus merceti Masi, 1931 : 424, 433–435, fig. 2. Holotype ♀, SPAIN: El Pardo (IEE, Madrid) [examined].

Very similar to *E. nigriclavis* but differing mainly in the fore wing venation. Only one female known.

BIOLOGY unknown.

DISTRIBUTION. Spain.

Species sola

Eunotus parvulus Masi

Eunotus (*Eunotellus*) *parvulus* Masi, 1931 : 424, 435–437, figs 3a–d, ♂♀. LECTOTYPE ♀, AUSTRIA: Wimpassing (NM, Vienna); here designated [examined].
Eunotus (*Eunotellus*) *aquisgranensis* Masi, 1931 : 424, 437–438. Holotype ♀, W. Germany: Aachen (NM, Vienna) [examined]. **Syn. n.**

Out of 1 ♀ and 4 ♂ of the original material of *E. parvulus*, 1 ♂ from Bohemia and 1 ♀ from Austria were designated by Masi as 'types'. Graham (1969 : 74) overlooked Masi's practice in designating types representing both sexes and mentions only the male as 'type' (and the other specimens as paratypes). I select the female as lectotype, as males of this species are not always safely recognizable.

Masi (1931) regarded *E. parvulus* and *E. aquisgranensis* as two different species, mainly on the difference in the relative lengths of the marginal and stigmal veins. I have found this character unreliable and have failed to find others. In 7 females examined the marginal vein is from 1·34 to 1·64 times as long as the stigmal vein, in another female (from Sweden) 1·8. The males are not always safely identifiable and that is why I measured only the specimens from Britain, where the occurrence of another similar species really is minimal. In 10 males the marginal vein showed ratio towards the stigmal vein between 1·6 and 2·1. The figures seem to be higher than in the females, but oddly enough among the females the highest figure, 1·64, is shown again by a British specimen. A similar finding, though in one female only, led Graham (1969 : 74) to regard his specimen as *E. aquisgranensis*.

DISTRIBUTION. Britain, Sweden, Germany (West), Austria, Czechoslovakia.

NEW RECORDS. BRITAIN: Esher Common, Surrey, 3 ♂, 21.vi.1970 (*Bouček*); Chobham Common, 1 ♀, 2 ♂, 19.vi.1970 (*Bouček*); Bald Hill nr Lewknor, Oxfordshire, 4 ♂, 13.vi.1970 (*Bouček*); Wytham Wood, Berkshire, 1 ♂, 26.vi.1964 (*Bouček*; published as *Eunotus* sp. in Bouček, 1965 : 83). SWEDEN: Västerbotten, Norsjö, 1 ♀, 5.vii.1956 (*Sundholm*); Blekinge, Sjöarp, 1 ♀, 12.vii (*Hedqvist*). CZECHOSLOVAKIA: Bohemia, Křesín nr Libochovice, 1 ♀, 31.vii.1943 (*Hoffer*); Praha-Chuchle, 1 ♂, 1 ♀, 24.vi.1955 (*Bouček*); Slovakia, Slov. Nové Mesto, Piliš Hill, 1 ♀, 31.v.1952 (*Hoffer*); Somotor, 1 ♀, 1.vii.1952 (*Kocourek*). AUSTRIA: 'Vimpacs' (=Wimpassing), Leitha Mts, 1 ♀, 20.vii.1915 (*Ruschka*), NM, Vienna.

MISCOGASTERINAE

SUSTERAIA gen. n.

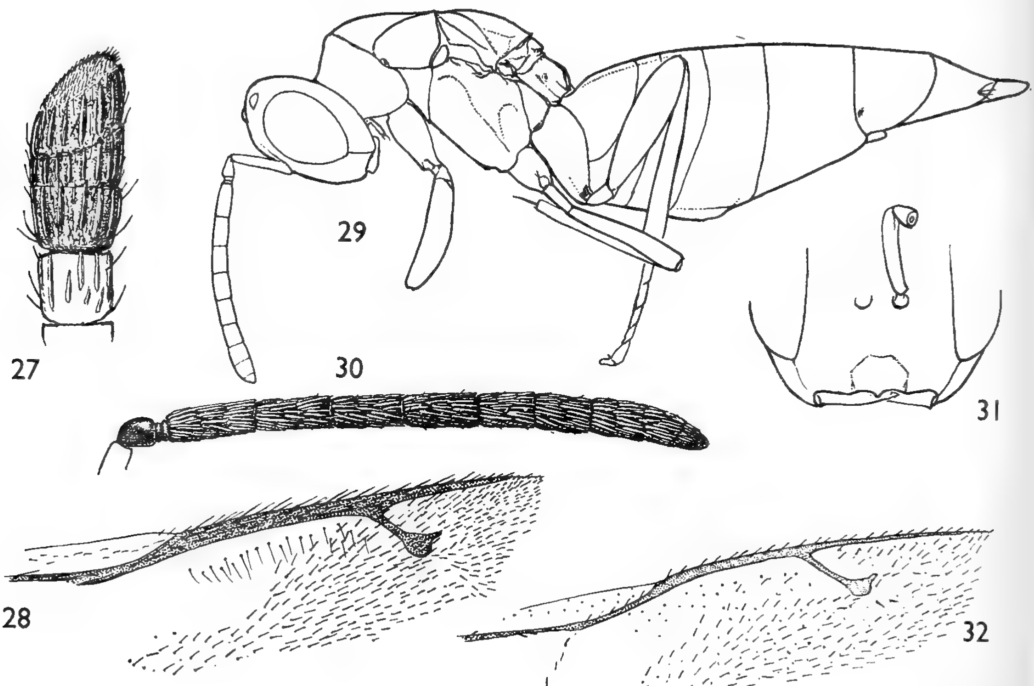
(Text-figs 29–32)

Type-species: *Susteraia acerina* sp. n.

Body metallic. Head and thorax very finely raised-reticulate, pilosity inconspicuous. Occiput not margined, temples and genae terete. Scrobes shallow. Lower face not protuberant. Clypeus very finely reticulate-punctulate, subtrapezoidal, weakly transverse, its

upper margin indicated by impressed line, diverging lateral margins slightly raised below, lower margin with distinct tooth in the middle, broadly emarginate on either side (Text-fig. 31). Malar space not concave. Mandibles with lower margin lamelliform at base, margin nearly straight. Labio-maxillary complex normal in both sexes. Antennae inserted near centre of face, well above lower ocular line, in both sexes 13-segmented, filiform, with two anelli, all funicle segments in female elongate, decreasing in length, the first longer than the pedicellus; clava with both sutures nearly perpendicular. In male antenna similar, though slightly longer, each funicle and clava segment with several dense irregular rows of sensilla linearia but otherwise nearly bare, with sparse microscopic semidistant hairs (Text-fig. 30).

Thorax fairly convex and elongate (Text-fig. 29). Pronotum rounded, rather short medially, lateral panels shallowly concave. Notauli complete, broad and deep, on bottom smooth between crenulae, as well as the axillar furrows which meet the mesoscutum well inside of notauli. The scuto-scutellar suture fairly sinuate. Scutellum elongate, convex, broadly meeting mesoscutum, frenal groove straight, in 3/4 of scutellum, frenum more coarsely reticulate than the disc; axillulae distinctly separated, bearing some longitudinal rugae. Dorsellum convex, shallowly alutaceous. Propodeum transversely strongly convex, posteriorly deeply emarginate, foramen bordered by high reflexed carina which extends to smooth crescentic nuchal strip in the middle; median carina fine, as long as frenum; plicae and nucha absent; spiracles of medium size, elliptical, removed from anterior margin; part behind them deeply depressed down to narrow supracoxal flange; callus convex, generally with one row of weak hairs. Prepectus broad, reticulate, without oblique carina, groove-like along upper and hind edge near tegula. Mesepisternum reticulate, on ventral side with some hairs, epimeron mainly smooth, at least above, in middle with asymmetrically arched groove. Metacoxa reticulate,



FIGS 27–32. 27–28. *Semiotellus rujanensis*. 27, apex of ♀ antenna; 28, fore wing venation. 29–32. *Susteraia acerina*. 29, body of ♀ in lateral view; 30, ♂ flagellum with pedicellus; 31, head of ♀ in facial view; 32, fore wing venation in ♀.

bare dorsally, laterally broadly depressed. Legs slender, hind tibia with two spurs. *Fore wing* with slender venation (Text-fig. 32), without hyaline break at end of parastigma; marginal vein about twice the stigmal and slightly shorter than the postmarginal; stigma small; pubescence weak, not dense, marginal ciliae short, basal fold with some hairs, basal cell bare and open below as well as speculum which extends far below marginal vein.

Gaster in female long and strongly compressed from sides, hypopygium reaching about one-third along, its tip emarginate. Petiole extremely short, in middle linear. First tergite short, its hind margin weakly emarginate in the middle; second tergite the shortest, the sixth the longest, about 1·5 times as long as epipygium which is rather large, unusually high in lateral view (Text-fig. 29), cerci at its lower margin in apical fifth, their bristles short. Ovipositor shortly protruding. Gaster finely transversely alutaceous, on sides and at apex with inconspicuous dark hairs. Male gaster narrow and short; petiole moderately transverse, smooth.

Named in honour of my old friend and teacher, Mr O. Šustera of Prague, a hymenopterist, who more than 60 years ago proposed the first reasonable basis for the taxonomy of the European Pompilidae.

Susteraia gen. n. belongs to Miscogasterinae, tribe Miscogasterini and in Graham's key to genera (1969 : 150–155) it may be easily keyed out by inserting the following paragraphs instead of 18 (17):

18 (17) Antennae short, in ♀ combined length of flagellum plus pedicellus less than, in ♂ at most equal, to the breadth of head; pedicellus longer than the first funicle segment; lower margin of clypeus laterally excised, in the middle with a broad tooth accompanied on either side with another weaker tooth; interantennal space convex, much broader than diameter of torulus. ***NODISOPLATA*** Graham

– Antennae much longer, flagellum plus pedicellus much longer than breadth of head; pedicellus shorter than first funicle segment; clypeal margin shallowly emarginate laterally and with a simple, rather sharp tooth in the middle; interantennal space not broader than torulus 18a

18a (18) Mid lobe of mesoscutum and scutellum flat; scutellar disc delimited by axillular furrows and frenal furrow subquadrangular, with sides nearly parallel, surface delicately engraved-reticulate; gaster not long, dorsally flat, not compressed from sides; propodeum smooth or nearly so, median carina indistinct, petiolar margin low . . . ***KSENOPLATA*** Bouček

– Mid lobe of mesoscutum and scutellum very distinctly convex, sides of scutellum clearly converging forward, the disc densely reticulate, not shiny; gaster long, in ♀ distinctly compressed from sides; propodeum reticulate-rugulose, with distinct median carina . . . . . ***SUSTERAIA*** gen. n.

Susteraia acerina sp. n.

(Text-figs 29–32)

♀. Body mainly vivid cupreous, head and thorax in places slightly violaceous, thoracic pleurae and gaster basally red to golden, gaster dorsally and posteriorly mostly dark purple. Scapes, pedicels, mouth parts, tegulae and legs apart from coxae, reddish testaceous; tarsi paler except apex. Wings hyaline, venation testaceous. Length 3·8–4·1 mm.

Head 1·16 times as broad as mesoscutum, dorsally twice as broad as long, with temples hardly one-third as long as eyes, rounded, receding. POL about 2·1 times OOL. In facial view head about 1·26 times as broad as high. Lower face at mouth margin with 6 longish hairs, which are about three times as long as the normal inconspicuous pubescence. Relative measure-

ments: head width 58, height 46·6, frons width 31, eye 30·5 : 22, malar space 9, width of mouth 27, length of scape 21, pedicellus plus flagellum 82. Pedicellus dorsally twice as long as broad, first funicle segment 2·1 times, the fifth 1·4 times, the sixth 1·1 times as long as broad; clava hardly longer than two preceding segments together.

Thorax dorsally (collum not measured) about 1·7 times as long as breadth of mesoscutum. Pronotum without conspicuous smooth belt at hind margin, which is thin. Mid lobe of mesoscutum fully as long as broad. Scutellum, if axillulae excluded, about 1·3 times as long as broad. Propodeum extremely finely rugulose-reticulate, sublaterally from hind margin with a few longitudinal rugae; hind corner above coxa with a lobate supracoxal lamina. *Fore wing* relative measurements: length 184, width 70, subcostal cell 70 : 6, marginal vein 34, postmarginal 41, stigmal vein 17, distance between upper margin of stigma and postmarginal vein 9. Lower surface of costal cell with one row of hairs, sometimes narrowly interrupted in middle, doubled apically (Text-fig. 32).

Gaster very narrow, 1·4–1·45 times as long as head plus thorax combined (Text-fig. 29).

♂. Golden-cupreous, only gaster posteriorly dark purplish; flagellum beneath ochreous; scapus and legs except metallic coxae, pale testaceous. Length of body 2·8 mm. Relative size of eye 24 : 18, scapus 14 : 4, flagellum plus pedicellus (Text-fig. 30) 79, i.e., nearly 1·65 times the width of head. Pedicellus dorsally 1·2 times as long as broad, half as long as first funicle segment which itself is 2·5 times as long as broad, the sixth 1·6 times as long as broad, clava as long as two preceding segments combined. Fore wing slightly broader than in female, 134 : 57, relative length of marginal vein 27, postmarginal 29, stigmal vein 15, distance between stigma and postmarginal vein only 1·9 times the height of stigma. Gaster narrow, slightly shorter than thorax.

BIOLOGY. After receiving the specimen reared in the Ukraine, with the suggestion that it might be a parasite of a weevil in maple seed, I mentioned the matter to my colleague Dr Strejček, a keen coleopterist working mainly on Curculionidae. He collected various samples of seeds and actually succeeded in rearing one male of the parasite, but no species of the Curculionid genus *Bradybatus* which we presumed to be the host. It is possible, however, that the *Bradybatus* species leave the maple seed earlier, or that the damaged seed falls earlier as does the seed of *Sorbus* attacked by *Megastigmus brevicaudis* Ratzeburg (Hym., Torymidae). The taxonomic affinity of *Susteraia acerina* cannot exclude also a possibility that a Dipteron is the host, as may be suggested by a nice *Torymus* species reared from the same lot of maple seed.

Holotype ♀. CZECHOSLOVAKIA: Bohemia, Starkoč near Náchod, vii.1955 (*J. Macek*); in Bouček Collection.

Paratypes. CZECHOSLOVAKIA: Bohemia, Praha-Krč, ex seed of *Acer pseudoplatanus*, 1 ♂ (allotype), ii.1969 ex seed collected xii.1968 (*Strejček*). UKRAINIAN S.S.R.: Kiev, Botanical Garden, ex ?weevil in seed of *Acer pseudoplatanus*, 1 ♀, 13.iii.1968 (*M. Zerova*).

SEMIOTELLUS Westwood
(Text-figs 27, 28)

Semiotus Walker, 1834 : 288, 290. Type-species: *Semiotus mundus* Walker; designated by Westwood, 1839. [Homonym of *Semiotus* Eschscholtz, 1829.]

Semiotellus Westwood, 1839 : 70. [Replacement name for *Semiotus* Walker.]

Semiotellus rujanensis sp. n.

(Text-figs 27, 28)

Semiotellus sp. indet., Graham, 1969 : 254, 255, ♀.

♀. Bluish green; the following parts testaceous: knees, fore tibiae, narrow apices of mid and hind tibiae, tarsi except at apex. Wings hyaline, venation dark brown. Length 3·4–3·5 mm.

Head 1·1 times as broad as mesoscutum, in dorsal view about twice (in holotype 2·06 times) as broad as long, in facial view 1·27 times as broad as high. Piliferous punctures coarse, very distinct, numerous, but wanting laterad of paired ocelli, in front of median ocellus and on lower face dorsad and laterad of clypeus. POL 1·7 times OOL. Area between clypeus and antennae rather protuberant but not very convex transversely, separated from clypeus by deep furrow between the very deep large tentorial pits. Clypeus slightly transverse, minutely reticulate, its lower margin slightly arched, produced. Mandible 2-toothed, the upper edge of upper tooth broad, nearly straight, not notched. Malar space with deep fovea just behind upper end of malar sulcus. Relative width of frons 42, of head 65, eye 29 : 21, malar space 15, width of mouth 32, scape length 23, flagellum plus pedicellus 63. Scapus laterally 3·7 times as long as broad; pedicellus dorsally 1·6 times as long as broad, slightly longer than first funicle segment; basal funicle segments slightly elongate, the fifth subquadrate; flagellum moderately clavate, the segments slightly increasing in width up to second claval segment; clava in lateral view (Text-fig. 27) 2·4 times as long as broad, dorso-apically subtruncate, bearing here an extensive slightly convex area of micropilosity; the first claval suture perpendicular, the second distinctly oblique.

Head and thorax with inconspicuous, usually short, mainly dark pubescence, in spite of broad and very distinct piliferous punctures; the latter sparser on disc of mid lobe of mesoscutum and nearly absent from posterior half of scutellum. Apex of scutellum raised in middle. Propodeum medially one quarter the length of scutellum, steeply elevated into median ridge (rather than carina), all over finely reticulate, with some rather fine irregular rugae; plicae distinct, straight; spiracle large, its diameter equal to breadth of the lateral smooth strip of metanotum. Basal cell of *fore wing* bare, basal and cubital folds also nearly bare, with at most one hair. For venation see Text-fig. 28. Relative length of marginal vein 42, postmarginal 25, stigmal vein 13, distance of the slightly enlarged stigma from postmarginal vein about 1·7 times its height.

Gaster slightly longer and distinctly broader than thorax, itself about 1·6 times as long as broad. First tergite nearly as long as three following tergites combined. Pubescence of gaster mainly dark, relatively short, also bristles of cerci subequal in length. Epipygium in median line hardly longer than median length of sixth or fifth tergite.

♂. Not known.

Biology not known. Collected by sweeping in mixed forest.

Holotype ♀. East Germany: Isle of Rügen, Baabe, vii.1960 (*Bouček*); presented to BMNH.

Paratype. 1 ♀, collected with the holotype; in NM Prague.

Named after Rügen=Rujana, old Slavonic name of the Isle.

This is the most distinctive species of the genus, differing from all other European species mainly by the large body with extremely short pubescence on head and thorax, the antenna with large area of micropilosity in female, rather short gaster and not having one cercal bristle unusually long. Graham (1969 : 254, 255) mentions this species as 'sp. indet.' and states that the area of micropilosity is on ventral face of the clava (as it is commonly in Pteromalidae), while it is in fact placed dorso-apically.

PTEROMALINAE

VELTRUSIA gen. n.

Type-species: *Veltrusia rara* sp. n.

Occiput not margined, temples and genae terete. Eyes with extremely fine inconspicuous hairs. Scrobes fairly deep but not sharply delimited though slightly angulate in front of ocellus; interantennal callus distinctly raised and extending into scrobes and towards clypeus. Lower face not protuberant. Clypeus mainly minutely reticulate, smooth at lower margin, subhexagonal: upper margin finely groove-like, short, horizontal, then obliquely descending to moderately deep tentorial pits, then converging downwards as broad shallow grooves; lower margin arched, slightly produced. Mouth margin sublaterally simple, arched; malar space convex. Left mandible 3-toothed. Lower edges of antennal toruli in lower ocular line. Antenna in female 13-segmented, with two anelli; pedicellus hardly longer than first funicle segment; funicle filiform, with segments decreasing in length; clava slender, bluntly pointed, both sutures perpendicular. Flagellum with pubescence short, inconspicuous, each segment of funicle and clava with one row of sensilla.

Thorax elongate, not depressed, dorsally as well as head mainly rugose-reticulate, clothed with distinct and fairly dense dark hairs. Pronotum narrower than mesoscutum, collar sharply margined, hind margin emarginate with broad smooth belt; lateral panel shallowly concave, relatively broad. Notaular furrows complete, moderately deep. Scutellum broadly meeting mesoscutum, axillar furrows intercepted well inside of notauli; frenal furrow rather deep but irregular, wavy; frenum taking up apical quarter, its sculpture coarse longitudinal, raised reticulation; furrows of axillulae diverging, anteriorly deep, weak posteriorly. Dorsellum forming transverse crest behind basal crenulae, its posterior face reticulate. Propodeum reticulate, with coarse rugae in deep places; median carina rather irregular though high and raised anteriorly into a triangle which is blunt at top; plicae sharp, arched, slightly converging and high posteriorly; nuchal strip crescentic, irregular but distinct, separated from disc by deep cross-furrow with coarse crenulae; hind corner formed by sharp vertical irregular edge; pubescence of callus moderately long, not dense, whitish; supracoxal flange not conspicuous. Metapleura, mesepisternum and lower epimeron retiulate, upper epimeron smooth and reaching far down along the vertical subdividing furrow which is more fovea-like above where it turns towards metapleura. Prosternum with mesolcus. Hind coxa reticulate, dorsally bare. Hind tibia with outer spur only half as long as the inner one. Legs relatively slender, basitarsi generally as long as two following segments combined. *Fore wing* pubescence dense on disc, marginal fringe short; basal fold hairy, cubital fold hairy except at proximal half of basal cell, the latter also with a few hairs below submarginal vein and on disc; speculum broad but closed below (Text-fig. 34). Veins slender, marginal vein subequal to the postmarginal and nearly twice as long as the straight stigmal vein; the latter hardly knobbed. Parastigma rather stout, ending in a pale break.

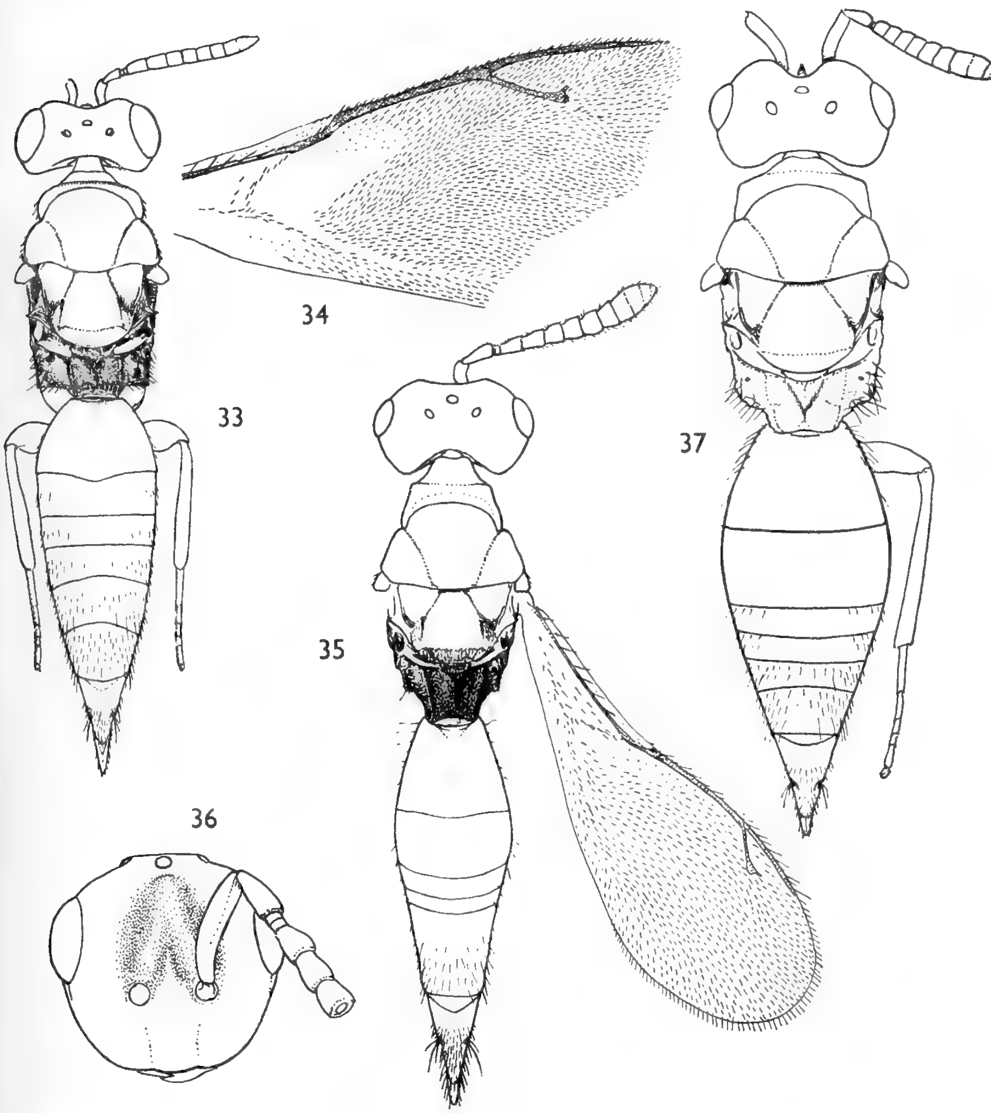
Gaster of female long, convex, lanceolate, posteriorly and laterally with dark hairs. Petiole very short, hidden, nearly smooth. First tergite moderately long, its hind margin subangularly produced in median two-quarters; tergites 2 to 4 subequal (Text-fig. 33), with hind margins nearly straight, the fifth tergite slightly longer than the fourth, the sixth still longer; one bristle of cercus slightly but not unusually longer. Ovipositor sheaths very slightly protruding. Hypopygium not reaching middle of gaster.

♂. Unknown.

Named after Veltrusy, a little town with old parkland in Bohemia, north of Prague, where the type-species and the two following new species (of *Strejcekia* gen. n.) were collected.

This is another aberrant member of Pteromalinae and as such is not easy to place

in the existing keys, for, because of complete notauli, it runs in them (Bouček *in* Peck, Bouček & Hoffer, 1964; Graham, 1969) to Miscogasterinae. From the latter subfamily it differs in having the postmarginal vein as long as the marginal, and from most other genera by the pronotum which is rather short and carinate in the middle.



FIGS 33–37. 33–34. *Veltrusia rara*. 33, ♀ body; 34, part of fore wing. 35–36, *Strejcekia elegans*. 35, body of ♀ with fore wing; 36, head of ♀ in facial view. 37, *Strejcekia brevior*, body of ♀. (Hind margin of fifth tergite omitted in Fig. 35).

From most genera of Pteromalinae *Veltrusia* gen. n. differs in having the notauli clearly complete. In Graham's key it runs near to *Dorcatomophaga* Kryger, together with *Strejcekia* gen. n. described below. Both these new genera differ from *Dorcatomophaga* by several characters which may be summed up in the following way, altering the key by Graham on p. 360, couplet 41 (40).

41 (40) Notauli complete, distinctly impressed throughout except sometimes just at the hind margin of mesoscutum; hind corners of propodeum with vertical ridge jutting over the base of hind coxa, the corner in dorsal view usually sharp, rectangular or acute; gaster usually convex 41a

– Notauli almost always incomplete and reaching at most somewhat more than half way across the mesoscutum; very rarely traceable to its hind margin but then very superficial posteriorly, and propodeum not sharp-angled when viewed from above 42

41a (41) Pronotal collar with sharp carina; centres of antennal toruli above level of ventral edge of eyes; postmarginal vein about as long as the marginal; plicae of propodeum sharp and high, though slightly irregular; median carina raised to a tooth anteriorly . . . . ***VELTRUSIA*** **gen. n.**

– Collar rounded, without distinct carina; antennal toruli below the lower ocular line; postmarginal vein shorter than the marginal 41b

41b (41a) Antennal scrobes shallow, without subdividing median crest; lower face radiately striate and bearing only short, inconspicuous hairs; eye longer than malar space; pronotum in dorsal view not forming angular shoulders; marginal vein slightly thickened; propodeum shallowly reticulate-punctured, median carina and plicae obliterated; gaster alutaceous all over. ***DORCATOMOPHAGA*** Kryger

– Scrobes deep and in lower half (or more) separated by the median crest; lower face not striate but clothed with conspicuous long hairs; pronotum in dorsal view with subrectangular shoulders, though much narrower than mesoscutum; marginal vein slender; propodeum very deeply reticulate-punctured, dull (Text-fig. 35), with high crest-like plicae and median carina, the latter raised and widened anteriorly; gaster at least anteriorly mainly smooth. ***STREJCEKIA*** gen. n.

Veltrusia rara **sp. n.**

(Text-figs 33, 34)

♀. Black with dark green or dull bronze tinge, which is slightly more vivid on vertex and thoracic dorsum. Scapes and legs beyond coxae mainly brownish testaceous, femora more or less infuscate, trochantins and knees paler. Mandibles and palpi fuscous. Pedicellus fuscous, flagellum black. Wings subhyaline, veins brown. Length 4 mm.

Head fully 1·1 times as broad as mesoscutum, fully twice as broad as long (52 : 25) in dorsal view, with temples moderately receding, only one-fifth the length of eyes. POL to OOL as 11·5 to 6·5, lateral ocellus slightly nearer to the anterior one than to occiput; relative width of vertex 30, eye 25 : 19·5, malar space 14, mouth width 21, height of head 43, width 52. Inner eye orbits very slightly diverging downward. Scrobes above ending about one diameter from ocellus. Fine reticulation behind malar sulcus engraved, alutaceous. Relative length of scapus 22, flagellum plus pedicellus 60, i.e., 1·15 times width of head. Pedicellus dorsally twice as long as broad, distinctly narrower than funicle; both anelli combined about as long as broad; first funicle segment 1·5 times, the sixth 0·9 times as long as broad, clava 2·2 times as long as broad.

Thorax (Text-fig. 33) from collar margin down to apex of propodeum about 1·6 times as long as broad. Relative length of collar in the middle 4, at sides in dorsal view 12, length of mesoscutum in middle 30, scutellum 26. Mesoscutum finely transversely reticulate, with bases of hairs raised. Scutellum on disc minutely engraved-reticulate, with scattered piliferous punctures, part between axillulae and in front of frenum as long as broad, axillulae moderately sloping, rather broad. Propodeum medially half as long as scutellum, the raised nuchal strip confined to apical quarter. Oval spiracles removed by their longer diameter from metanotal margin. *Fore wing* relative length 154, width 61, costal cell 52 (width about 5), marginal vein 36, postmarginal 36, stigmal 20, distance between stigma and postmarginal vein 8. Lower surface of costal cell hairy, hairs proximally reduced to incomplete double line.

Gaster nearly 1·3 times as long as head plus thorax combined, 3·1 times as long as broad itself, broadest in basal third. First tergite slightly shorter than three following tergites combined, the fourth with hind margin slightly emarginate; first tergite smooth, laterally near base with a few hairs, the following tergites basally with obliterated alutaceous sculpture, the fifth and sixth slightly more distinctly engraved-reticulate with raised piliferous punctures (except at hind margin).

♂. Unknown.

BIOLOGY unknown. Judging from the taxonomic characters the species may be a parasite of xylophagous beetles, most probably of Anobiidae. The specimen, along with the two species of *Strejcekia* described below, was beaten from bushes and trees in an old park.

Holotype ♀. CZECHOSLOVAKIA: Bohemia, Veltrusy, 9.v.1959 (*J. Strejček*); in Bouček Collection.

Together with Dr Strejček and my assistant we have been trying to get some more material of these interesting forms, which seem to be very rare (hence the specific name), but without success. In the meantime I consulted various colleagues and we agreed that the three specimens, collected in one spot, on the same day, belong to two new genera and to three new species. It is only now, after more than ten years, that I am publishing their descriptions.

STREJCEKIA gen. n.

(Text-figs 35–37)

Type-species: *Strejcekia elegans* sp. n.

Body hardly metallic; head and thorax reticulate, reticulation mainly obliterated dorsally but very deep on propodeum; gaster nearly smooth. Head with eyes relatively small, their pubescence short, not conspicuous. Occiput not margined but with unusually coarse rugose reticulation; temples and genae terete. Scrobes not margined, rather deep; interantennal crest high, reaching narrowly far into scrobes and also downward, as convex supraclypeal area. Lower face not protuberant, distinctly hairly, not radiately striate. Clypeus very narrow, ill-defined above, its lower margin more or less produced and thin, surface not striate. Sublateral margins of mouth not sinuate. Mandibles small, normal, 3-toothed, upper tooth trancate. Antennae in female not very long (Text-figs 35, 37), 13-segmented, inserted below lower ocular line, not far below middle of face. Scapus slender, distinctly longer than eye; pedicellus longer than first funicle segment; two short anelli: flagellum weakly clavate, the six segments of funicle gradually decreasing in length, each segment narrowing basad and generally with one row of sensilla; three-segmented clava blunt at apex, with sutures almost perpendicular.

Thorax not depressed, elongate. Pronotum much narrower than mesoscutum, collar only bluntly set off (not carinaceous), in dorsal view with distinct angular shoulders, in middle short

but side panels rather long, shallowly concave. Notauli complete, not very shallow. Scuto-scutellar suture nearly straight, separated from scutellum by a cross-furrow. Scutellum reticulate, frenal furrow marked by deep bases of irregular longitudinal grooves of frenum. Dorsellum short, very deeply reticulate-punctured as is the propodeum, dull. Propodeum with broad, ridge-like median carina rising into a blunt tooth anteriorly and with more or less distinct, equally ridge-like, subparallel plicae; spiracles small, oval; part laterad and caudad of spiracle in addition to the reticulation coarsely and irregularly rugose; callus with irregular longitudinal ridge; hind corners of propodeum jutting over base of metacoxa and with a vertical ridge, but not nearly reaching level with the protruding median part of propodeum, which forms, however, no neck; no conspicuous supracoxal flange. Prepectus large, with distinct vertical ridge anteriorly, depressed on disc. Mesopleura and metapleura mainly deeply reticulate; mesepimeron with deep fovea above the middle, in front of fovea with a vertical strip of shallower sculpture. Hind coxa reticulate, dorsally bare. Legs fairly slender, hind tibia with only one distinct spur. Basitarsi of all legs long, dorsally fully as long as following two segments together. *Fore wing* moderately densely hairy, marginal fringe of medium length; costal cell unusually narrow; basal fold hairy but speculum open or closed below; veins slender, marginal vein at most as long as the postmarginal, much longer than the stigmal which is hardly knobbed.

Gaster in female (Text-figs 35, 37) convex, conically lanceolate, nearly smooth and only poorly pubescent posteriorly. Petiole short and mostly hidden under the propodeum, but with several coarse longitudinal rugae. Hind margins of tergites mainly straight, the first and second relatively large though not reaching middle of gaster. Epipygium not very long, with a group of denser short hairs in front of the cercus, which has one bristle conspicuously longer than the others. Ovipositor sheaths hardly protruding. Hypopygium reaching middle of gaster.

Males not known.

Named in honour of Dr J. Strejček of Prague, a keen entomologist working in nature conservation, to whom I am indebted for some very interesting material of Chalcids.

Strejcekia gen. n. also comes near to *Dorcatomophaga* Kryger and its distinguishing characters are summed up above along with *Veltrusia* gen. n.

Key to Species

Females

1 Body slender (Text-fig. 35), thorax dorsally fully 2·3 times as long as breadth of pronotum; antennae longer, flagellum plus pedicellus combined about 1·4 times as long as breadth of head, funicle segments 1–4 not transverse; scrobes only moderately deep, not sharply delimited above and not reaching near to the median ocellus; interscrobal callus blunt, not very high (Text-fig. 36); median part of propodeum strongly protruding beyond posterolateral corners, the strong ridgelike plicae slightly longer than distance between them anteriorly . . ***elegans*** sp. n. (p. 297)

– Body broader (Text-fig. 37), thorax dorsally only 1·9 times as long as breadth of pronotum; antennae shorter, stouter, flagellum plus pedicellus combined distinctly shorter than breadth of head; funicle segments 1–6 strongly increasingly transverse; scrobes very deep, abruptly ending about one diameter before ocellus, interscrobal crest narrow, high and sharp; median part of propodeum only slightly protruding beyond level of posterolateral corners (above base of coxa); weak plicae only about two-thirds as long as distance between them anteriorly. ***brevior*** sp. n. (p. 297)

Strejcekia elegans sp. n.

(Text-figs 35, 36)

♀. Body black, dorsally with very slight dark green tinge. Legs, base of antennae and tegulae dark testaceous; flagellum except anelli fuscous, also coxae infuscate basally. Wings subhyaline, venation pale testaceous. Length 2·4 mm.

Head in dorsal view broader than mesoscutum as 35 : 30, than the pronoum as 35 : 22·5, itself 1·75 times as broad as long, with temples about three-quarters the length of eyes but rather strongly arcuately receding; occiput deeply emarginate, taking up slightly more than half the head breadth. POL equals OOL. Frons laterally strongly convex. Scrobes moderately deep, above ending nearly two diameters from the ocellus, but not well delimited. Interantennal callus (Text-fig. 36) blunt and fading out slightly above middle of scrobes. Eyes prominent though small, with distinct short pubescence. Relative measurements: head width 35, height 31, width of frons 26, oval eye 12 : 9, malar space 13·5, mouth width 20, distance between lower margin of clypeus and antennal toruli 11·5, scapus length 17, flagellum plus pedicellus 49, i.e., 1·4 times the width of head. Scapus reaching level with lower edge of median ocellus; pedicellus dorsally 2·4 times as long as broad and as long as anelli plus first funicle segment; both anelli together shorter than broad; first funicle segment with sensilla confined to distal half, basally constricted, about 1·5 times as long as broad; the fifth and sixth segment slightly transverse. Clava about 2·2 times as long as broad, apical nipple with small area of micropilosity.

Thorax measured from anterior margin of collar to apex of propodeum nearly 1·8 times as long as breadth of mesoscutum, fairly convex. Hind margin of pronotum smooth, deeply emarginate. Mesoscutum and scutellum distinctly hairly, fairly shiny as the reticulation is rather fine and shallow. Mid lobe of mesoscutum strongly convex, 1·1 times as broad as long. Scutellum slightly elongate, at apex subtruncate; frenum taking up more than apical one-quarter, coarsely longitudinally rugose; disc of scutellum nearly smooth, very finely alutaceous, with scattered fine piliferous punctures. Axillulae short, moderately sloping, dull, deeply reticulate. Dorsellum of metanotum dull, deeply reticulate-punctured as is the propodeum. Apex of protruding median part of propodeum emarginate, not margined; median ridge triangularly expanding and rising towards base; spiracle very small, round; lateral callus with a longitudinal crest, the hairs thin and not dense. Hind femur nearly 6 times as long as broad, clothed sparsely with thin and long hairs. Wings hardly exceeding apex of gaster. *Fore wing* narrow (Text-fig. 35), regularly rounded at apex, relative length 110, width 40, costal cell 43 : 3, marginal vein 25, postmarginal 20, stigmal vein 10. Lower surface of costal cell with only one row of hairs, this precurrent; submarginal vein smoothly joining parastigma; anterior margin of wing with marginal and postmarginal vein forming a smooth arch; stigmal vein angle about 45°, stigma very small, subtriangular, the short uncus almost parallel to postmarginal vein. Base of wing almost all hairy but hairs sparse, rather long; speculum very small. Hind wing relative length 85, width 19, longest fringe 3; fairly broadly rounded at apex.

Gaster narrower than mesoscutum, about 1·2 times as long as head plus thorax combined, itself 3·2 times as long as broad, smooth, posteriorly bearing some sparse long thin hairs.

♂. Not known.

Biology not known.

Holotype ♀. Czechoslovakia: Bohemia, Veltrusy, 9.v.1959 (*Strejček*); in Bouček Collection.

Strejcekia brevior sp. n.

(Text-fig. 37)

♀. Black; propodeum and base and apex of gaster slightly brownish; scapes and pedicels

and legs apart from coxae mainly pale testaceous, pedicels and femora slightly infuscate. Wings subhyaline, venation light brown. Length 2·7 mm.

Head slightly broader than mesoscutum (as 42 : 38; Text-fig. 37), in relation to pronotum as 42 : 31, itself in dorsal view 1·75 times as broad as long, with temples about 0·7 the length of eyes. POL to OOL as 11 : 8. Frons on sides strongly protuberant, rounded; scrobes deep, narrowing above and there in the middle angulately delimited, only about one diameter in front of ocellus; interscrobal crest narrow, high, sharp up to half of scrobes, more dorsally much lower but still distinct. Lower face below antennal toruli subhorizontally rugose-striate, irregularly rugose nearer to mouth. Also gena dull, deeply irregularly rugulose, malar sulcus below replaced by a blunt ridge. Relative measurements: width of head 42, height 36, width of frons 30, oval eye 15 : 11, malar space 17, mouth width 18, scapus length 18, flagellum plus pedicellus 37, i.e., 0·88 the head width. Pedicellus dorsally hardly 1·5 times as long as broad; first funicle segment about 1·5 times, the sixth about twice as broad as long; clava less than twice as long as broad.

Thorax dorsally from anterior corners down to apex of propodeum 1·57 times as long as breadth of mesoscutum. Sculpturally similar to *S. elegans* but all parts shorter, broader (hence the specific name); scutellar frenum posteriorly reticulate; mid lobe of mesoscutum only weakly convex, anteriorly cross-striate-alutaceous; notauli shallower but clear-cut down to scuto-scutellar suture. Scutellum as long as its maximum breadth measured between axillulae. Dorsellum truncate when seen from in front or from behind, with sublateral parts rather high. Propodeum in middle two-thirds the length of scutellum, median carina in anterior two-thirds replaced by large triangular blunt tooth the apex of which is in line connecting the postero-lateral corners of propodeum; these blunt in dorsal view but formed by short, vertical ridge. Callus inconspicuously hairy. Hind femur 5 times as long as broad, dorsally with short pubescence, only on lower edge at apex with some longish hairs. *Fore wing* relative measurements: length 112, width 41, costal cell 44, marginal vein 24, postmarginal 24, stigmal vein 11. Basal cell bare; speculum of medium size, reaching broadly cubital hair-line; posterior corner of fore wing blunt but distinct, at level with stigmal vein, apex of wing thus asymmetrically rounded, more strongly so anteriorly than posteriorly (unlike in *S. elegans*).

Gaster as broad as mesoscutum, 1·12 times as long as head plus thorax combined, itself about 2·2 times as long as broad. First tergite the longest, anteriorly on sides with a loose patch of longish hairs, apex of gaster with relatively short hairs, epipygium with very short hairs; second tergite shorter than the first as 16 : 22, but nearly as long as three following tergites (3–5) together.

♂. Not known.

Biology not known, but as in the preceding species, the morphological affinity suggests parasites of xylophagous beetles, probably with some rather cryptic way of life, as may be judged from the relatively small eyes and, at least in *Strejcekia elegans* sp. n., from the rather long and thin hairs on the gaster.

Holotype ♀. Czechoslovakia: Bohemia, Veltrusy, 9.v.1959 (*Strejček*); in Bouček Collection.

RHIZOMALUS gen. n.

(Text-figs 41, 42)

Type-species: *Rhizomalus cupreus* sp. n.

Head and thorax very finely and densely, but shallowly, reticulate, very shortly and fairly densely hairy, piliferous punctures very distinct. Head in dorsal view moderately transverse; occiput slightly emarginate, not margined; frons convex, scrobes distinct but not very deep

Lower face not protuberant, finely radiately reticulate to striate (Text-fig. 41); genae convex, posteriorly rounded. Clypeus small, tentorial pits and upper margin not distinct, the lower margin truncate. Left mandible 3, the right 4 teeth, not large, moderately curved. Antennae in both sexes rather short, 13-segmented, inserted slightly above lower ocular line but below centre of face. Scapus hardly broadening distally, sublinear, not nearly reaching median ocellus; pedicellus longer than first funicle segment; two short anelli; flagellum rather stout, sublinear, all funicle segments transverse, almost equal in length, each with one row of longitundinal sensilla, in ♀ very shortly haired, hairs longer in ♂; clava ovate, bluntly pointed, its sutures perpendicular, micropilosity area reduced to terminal nipple.

Pronotum rather short, collar in middle sharply carinaceous; in dorsal view not forming shoulders on sides. Mesoscutum with notauli indicated as superficial lines on anterior half; scuto-scutellar suture weakly sinuate laterally. Scutellum slightly convex, frenal groove barely perceptible. Metanotum linear. Propodeum very short, finely rugulose-reticulate, transversely convex; nucha represented by a narrow elevated strip; median carina vague or weak, plicae absent; callus sparsely hairy; spiracles small, short-oval, removed from metanotum by more than their diameter. Prepectus small, triangular, weakly reticulate, anteriorly without carina. Mesepimeron with distinct arched subdividing furrow, upper epimeron smooth, the lower more strongly reticulate than outer surface of hind coxa; the latter dorsally bare. Legs rather stout, hind femur only slightly more than 3 times as long as broad; hind tibia longer than femur, with one spur; mid tibia with spur longer than width of tibia at apex, slightly shorter than basitarsus dorsally. *Fore wing* pilosity dense and very short (Text-fig. 40), marginal ciliation developed throughout; costal cell broad; parastigma slightly thickened and distally with a pale break; marginal vein very slightly thickened, hardly shorter and much broader than the postmarginal, slightly longer than the stigmal vein; the latter with small stigma. Basal cell mainly open below but more or less hairy at the basal hair-line; speculum not reaching marginal vein, mostly open below.

Gaster sublanceolate, dorsally mostly depressed. Petiole very short, hidden, smooth. Basal tergite with hind margin mainly entire. Bristles of cerci subequal in length to the normal pilosity. Ovipositor not exserted. Tip of hypopygium situated about half way along the gaster.

In male, mouth with labiomaxillary complex and legs normal, as in female.

The genus *Rhizomalus* seems to be nearest to *Hobbya* Delucchi and *Cecidostiba* Thomson, both morphologically and biologically. In Graham's key to the genera of the European Pteromalinae (1969 : 353–409) the female runs to couplet 132 and may be keyed out there in the following way.

132 (131) Fore wing broadly suffusedly infumate below marginal vein, the latter slightly thickened, shorter than the postmarginal and little longer than the stigmal vein; stigma very small; basal cell hairy in distal quarter or more. Propodeum short, plicae indistinct. Antennae very short, all funicle segments transverse; pedicelus about twice as long as the first funicle segment . . . . ***RHIZOMALUS*** gen. n.

– Fore wing hyaline or with different fuscous markings; marginal vein not thickened and not shorter than the postmarginal vein; basal cell usually bare; stigma either relatively large or propodeum about half the length of the scutellum. Antennae much longer, basal segments at least slighty elongate 132a

132a (132) Here Graham's couplet 132, keying out *Cecidostiba* Thomson and *Nephelomalus* Graham

The male runs in Graham's key to couplet 128 (p. 404), partly to *Pegopus* Förster, but differs from that genus as follows.

a Antennae short, scapus not nearly reaching the ocellus, all funicle segments distinctly transverse; left mandible 3-toothed . . . . ***RHIZOMALUS*** gen. n.

– Antennae not so short, scapus reaching to the level of vertex, funicle segments subquadrate or slightly elongate; both mandibles 4-toothed . . ***PEGOPUS*** Förster

Rhizomalus cupreus sp. n.

(Text-figs 41, 42)

♀. Cupreous; head and thoracic dorsum more reddish, gaster basally more brownish metallic, apically purplish. Antennal base including anelli, then trochanters, knees, tibiae and tarsi testaceous; antennal flagellum blackish brown; coxae concolorous with thorax, femora extensively fuscous with metallic tinge, sometimes also tibiae slightly infuscate or gaster beneath brownish. Fore wing, except for subhyaline basal third, more or less yellowish to brownish infumate, more distinctly so on disc below marginal and stigmal vein; venation brown. Hairs on thoracic dorsum mainly dark. Length 2·4–3 mm.

Head distinctly broader than mesoscutum (51 : 44), in dorsal view 1·9 times as broad as long, i.e., rather stout, with temples moderately receding and hardly one-third as long as eye. POL 1·35 times OOL; ocellar triangle 2·2 times as broad as high. Eyes not prominent, with extremely short sparse hairs. Supraclypeal area slightly convex but not well delimited. Clypeus flat, depressed, more strongly receding towards mouth than the adjoining face, its lower margin smooth. Mouth margin thin, regularly arched. Relative measurements: head width 51, height 42, width of frons 35, eye 23 : 17·5, malar space 14, width of mouth 25, distance between upper edge of antennal toruli and median ocellus 20, flagellum plus pedicellus combined 39, i.e., 0·77 the head width. Pedicellus dorsally about 1·7 times as long as broad; flagellum hardly clavate (Text-fig. 41); first funicle segment 1·05–1·2 times as broad as long, the sixth about 1·6 times as broad as long; clava as long as 2·5 preceding segments combined.

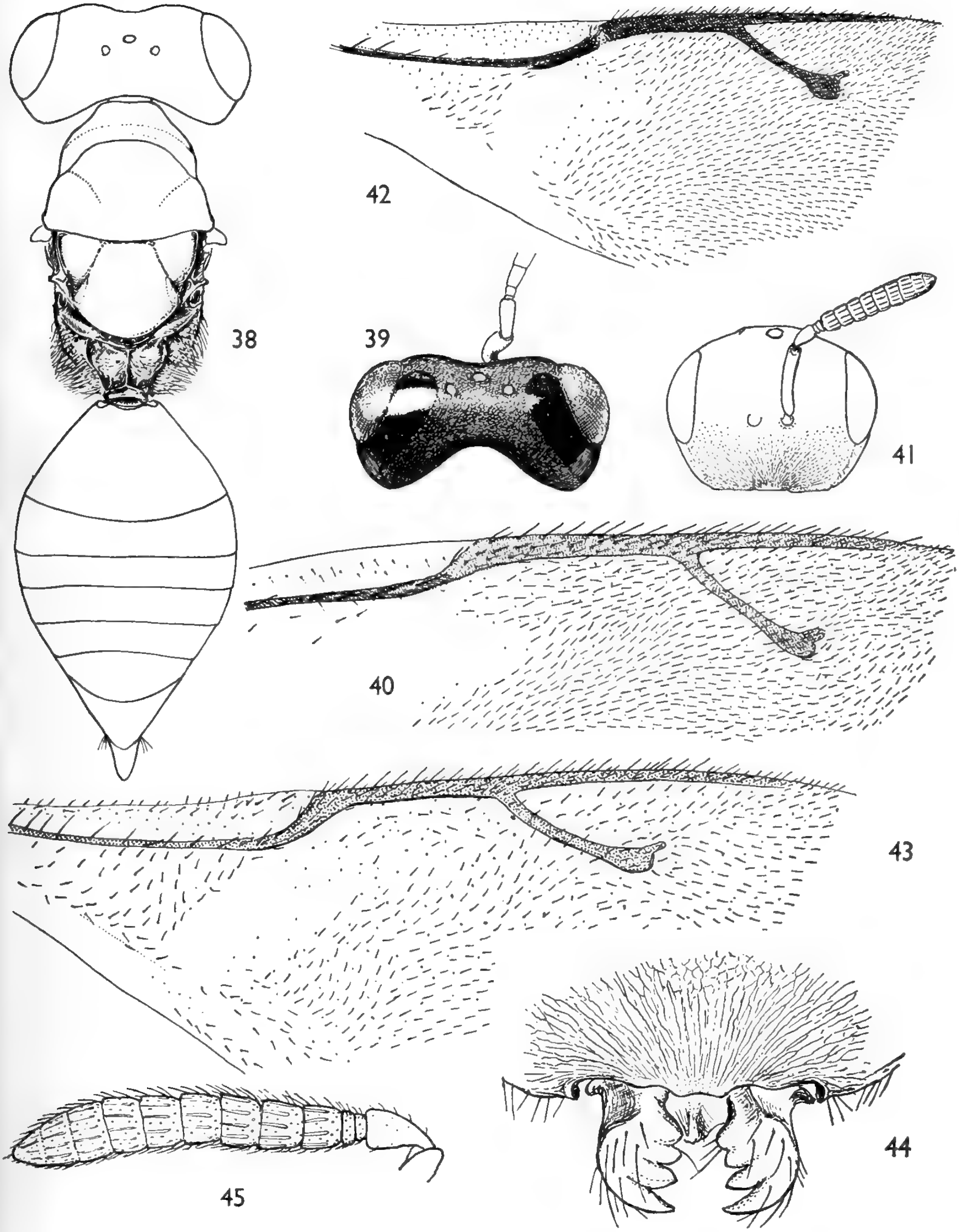
Pronotum with collar in middle about 1/8 the length of mesoscutum, its carinaceous anterior margin weakly arched, sides strongly diverging, slightly bulging posteriorly. Scutellum 1·1 times as long as maximum breadth less axillulae; frenum relatively shiny, its reticulation wide-meshed, obliterated; scutellar disc extremely densely reticulate, front margin meeting mesoscutum for one-quarter of mesoscutal breadth, as broadly as each axilla. Propodeum duller than disc of scutellum, in the middle less than one-third the length of scutellum; posterolateral corners rounded, with a small supracoxal flange. *Fore wing* broad (136 : 53), marginal vein 8·2–9·5 times as long as broad. Relative length of costal cell 46, marginal vein 22, postmarginal 24, stigmal vein 18 (Text-fig. 40).

Gaster 1·05–1·25 times as long as head plus thorax combined. First and second tergite in middle of hind margin sometimes submarginate, dorsally nearly smooth, the following tergites alutaceous basally. Weak pubescence on sides and apex of gaster dark.

♂. The two specimens available are unusually small, 1·6 mm. Head perhaps therefore relatively broader, 1·2 times as broad as mesoscutum. In colour very similar to female, but infumation of the fore wing weak. Flagellum plus pedicellus combined 0·86 the breadth of head; pedicellus dorsally scarcely 1·5 times as long as broad; all funicle segments distinctly transverse, clothed with semidistant hairs which are nearly as long as segments. Gaster hardly longer and much narrower than the thorax.

BIOLOGY. Reared from oak gall of the Cynipid *Andricus quercusradicis* (F.).

Holotype ♀. FRANCE: Côtes-du-Nord, Erquy-les-Bains (*H. B. Preston*); in BMNH.



FIGS 38–45. 38–40. *Peridesmia montana*. 38, body of ♀ with sculpture of propodeum indicated; 39, head of ♂; 40, part of fore wing of ♀. 41–42. *Rhizomalus cupreus*. 41, head of ♀ in facial view; 42, fore wing venation in ♀. 43–45. *Pteromalus paludicola*. 43, part of fore wing with venation and pilosity; 44, mouth region with mandibles; 45, ♀ flagellum with pedicellus.

Paratypes. BRITAIN: England, Oxfordshire, Bald Hill near Lewknor, 1 ♀, 15.vii.1960 (*Graham*); Graham Collection. CZECHOSLOVAKIA: Slovakia, Kováčov near Štúrovo, 1 ♀, 17.vii.1969 (*Bouček*). HUNGARY: Baja, ex gall of *Andricus quercusradicis*, 1 ♀, 6.viii.1961 (*Fekete*). YUGOSLAVIA: Dalmatia, Biograd na moru, 1 ♀, vii.1968 (*Bouček*). BULGARIA: Sandanski district, 3 ♀, vi.1969 (*Kocourek*). GREECE: Kalamaria near Thessaloniki, 4 ♀, 2 ♂ (one allotype), 1917 (*J. Waterston*), BMNH. Also 2 ♀ from the MOLDAVIAN S.S.R. (U.S.S.R.) examined but data not noted. Partly in Bouček Collection, partly in NM, Prague and BMNH, London.

PTEROMALUS Swederus

Pteromalus Swederus, 1795 : 201. Type-species: *Ichneumon puparum* Linnaeus; designated by Westwood, 1839.

Pteromalus paludicola sp. n.

(Text-figs 43–45)

♀. Bluish green; antennae blackish brown, scapes testaceous, infuscate at apex; legs except metallic coxae mainly reddish testaceous, but femora mostly infuscate, as well as fore tarsi and apex of mid and hind tarsi, sometimes also mid and hind tibiae infuscate. Wings hyaline, venation brown. Length 1·8–2·2 mm.

Head about 1·28 times as broad as mesoscutum, dorsally about 2·15 times as broad as long, temples about half the length of the eyes, converging moderately and rather straight. POL about 1·1 times the OOL, the latter equals about 3 diameters of lateral ocellus. Head in facial view transversely subelliptic about 1·23 times as broad as high; lower face with clypeus distinctly radiately striate (Text-fig. 44), lower margin of clypeus shallowly emarginate, medially depressed. Mandibles clearly 4-toothed. Genae slightly swollen just at mouth margin which is depressed from below at mouth corners and bordered by a groove sublaterally (seen from below). Relative measurements; width of head 50, of frons 32, eye 22 : 16, malar space 12, width of mouth 21, distance between lower margin of clypeus and antennal toruli 15, scapus 17·5, flagellum plus pedicellus 38·5, i.e., about 0·75–0·8 the breadth of head. Scapus relatively short, not nearly reaching to ocellus; pedicellus dorsally about 1·5 times as long as broad, distinctly longer than first funicle segment (Text-fig. 45); the latter slightly transverse, the following segments more transverse, sixth funicle segment about 1·4 times as broad as long; clava ovate-subacuminate, about as long (0·95–1·04) as three preceding segments combined. Flagellum hardly to slightly clavate, each funicle segment with one row of sensilla.

Thorax about 1·5 times as long as broad, dull, densely punctured-reticulate, rather unusually densely clothed with dark short hairs (conspicuous in lateral view). Dorsum not flattened. Pronotum 0·82 times as broad and medially one-sixth to one-seventh as long, as mesoscutum. The latter 1·74 times as broad as long, on disc with reticulations as dense as on scutellum but elsewhere more finely reticulate. Scutellum rather flat, hardly as long as broad, frenum not distinctly marked off sculpturally. Propodeum half as long as scutellum; median carina indicated only basally; plicae posteriorly at base of nucha very low; hairs of callus partly dark, rather dense also behind spiracle; depressed part above hind coxa and behind callus rather short. Legs moderately stout, hind femur 4·5 times as long as broad, hind tibia about 1·2 times as long as hind tarsus. *Fore wing* (Text-fig. 40) unusually extensively hairy, basal cell hairy all over, speculum usually closed below or nearly, lower surface of costal cell even basally with double or triple row of hairs. Relative lengths of veins: marginal 21, postmarginal 25, stigmal 15; in a paratype *m* : *pm* : *st* as 18 : 25 : 14.

Gaster about as long or slightly shorter than thorax, about 1·5–1·6 times as long as broad, dorsally depressed. Basal tergite occupying slightly less than one-third the total length.

♂. Not known.

Biology. Host not known. All specimens were collected in marshy habitats (hence also the specific name).

Holotype ♀. Czechoslovakia: Bohemia, Řevničov, 14.viii.1958 (*Bouček*); presented to BMNH.

Paratypes. Czechoslovakia: Bohemia, Břehyně near Doksy, 5 ♀, 17.vii.1963 (*Bouček*); partly in Bouček Collection, partly in NM, Prague.

Pteromalus paludicola sp. n. with its completely hairy basal cell can be easily separated from all the other European species of *Pteromalus* and *Habrocytus*, most of which are keyed in a combined key by Graham (1969 : 495–523). This character occurs otherwise only in some *Pteromalus venustus* Walker, as discussed by Bouček (1970 : 74) and, possibly, in the rather enigmatic *P. vopiscus* Walker (see Graham, 1969 : 492), which differs in having fairly convex scutellum. Otherwise both can be separated from *P. paludicola* as follows.

1 Length of flagellum plus pedicellus only 0·8 the width of head, all funicle segments transverse; clava about as long (0·95–1·04) as three preceding segments combined. Basal cell completely hairy, speculum mostly closed below **paludicola** sp. n. (p. 302)

– Flagellum plus pedicellus as long as 0·86–0·93 the width of head, proximal funicle segments not transverse; clava 1·24–1·3 the length of two preceding segments combined. Basal cell proximally bare, speculum open below. **venustus** Walker and **vopiscus** Walker

Another species similar to *Pteromalus paludicola* sp. n. is *Habrocytus crassicornis* (Zetterstedt) occurring in Czechoslovakia in the same habitats. It has similarly hairy wings and short antennae, but the left mandible is 3-toothed, lower face strongly striate, scutellum strongly convex, venation different, etc.

PERIDESMIA Förster

Peridesmia Förster, 1856 : 65. Type-species: *Isocyrtus* (*Trichomalus*) *aquisgranensis* Mayr; designated by Gahan, 1923.

Peridesmia montana sp. n.

(Text-figs. 38–40)

♀. Dark green, in places with bronzy or cupreous tinge; antennal scapes and pedicels as well as legs beyond coxae, testaceous; flagellum blackish. Wings subhyaline, venation testaceous. Length 2·8–3 mm.

Head fully 1·4 times as broad as mesoscutum (Text-fig. 38), in dorsal view 2·1 times as broad as long, with temples slightly less than one-third the length of compound eyes. POL 0·9–0·95 the OOL. Relative width of frons 37, width of head 64, eye 30·5 : 24, malar space 15·5, scapus 22. In facial view head 1·27–1·3 times as broad as high, with genae arched, strongly converging; mouth margin sublaterally strongly receding inward but distinctly produced at either side of clypeus. Flagellum plus pedicellus combined about 0·86 the width of head; pedicellus dorsally fully twice as long as broad; flagellum clavate, second anellus only slightly transverse; first funicle segment slightly broader than pedicellus, about 1·5 times as long as broad, the sixth about 0·75 times the breadth and 1·5 times as broad as pedicellus; clava subacuminate, as long as 2·5 preceding segments combined.

Thorax 1·6 times as long as broad, rather finely reticulate-punctured. Pronotum distinctly narrower than mesoscutum, as 38 : 45; collar indistinctly edged, in dorsal view sides diverging, not protruding. Mesoscutum about 1·8 times as broad as long, longitudinally moderately strongly convex. Scutellum fairly convex, as long as mesoscutum and slightly longer than its breadth measured posteriorly between axillulae. Propodeum medially 0·72 the length of scutellum; median carina and plicae very strong and high, plicae strongly sinuate; median area cordiform, fully 1·6 times as broad as long, its bottom rather shiny, with some obliquely diverging rugae and only traces of reticulation, in deeper parts nearly smooth, posteriorly delimited by highly carinaceous angulate edge of nuchal strip (Text-fig. 38); the strip in form of a low arched trapezoid, depressed and scarcely strigulose on disc, its sides subparallel, raised, nearly as long as the strip in the middle. Lateral parts of propodeum beyond spiracles and beyond posterior half of plicae densely hairy. *Fore wing* densely hairy on disc but nearly bare in basal third, with only a few short hairs near upper part of basal fold (Text-fig. 40); lower surface of costal cell with complete hair-row, partly doubled basally, double or triple distally. Relative lengths of veins: marginal 25, postmarginal 23, stigmal 17.

Gaster ovate-acuminate, depressed, slightly shorter than head plus thorax combined, broader than thorax but narrower than head. First tergite laterally densely hairy.

♂. In colour similar to female but more vividly cupreous on vertex and thoracic dorsum; the smooth strip on head (Text-fig. 39) blackish purple. Antennal flagellum dark testaceous except for blackish distal third. Length 2·5 mm.

Head very stout, 1·6 times as broad as mesoscutum and dorsally 1·9 times as broad as long, with the smooth strip very broad and long, touching the eyes and extending from the mouth corner up on temples and vertex forward to upper frons. POL about 0·8 the OOL. Antennae only slightly more slender than in female, flagellum plus pedicellus combined 0·8 the breadth of head, second anellus subquadrate, distal funicle segments subquadrate. Propodeum with median area still more shiny, with more distinct but sparser rugae, the reticulation traceable only on the disc; nuchal strip narrower than in female, its hind margin more raised. Gaster weakly convex, about three-fourths the length of thorax; first tergite covering one-half.

BIOLOGY not known. All three specimens were collected by sweeping grass on montane meadows.

Holotype ♀. CZECHOSLOVAKIA: Slovakia, Remetské Hámre, 10.vii.1960 (*Strejček*); in Bouček Collection.

Paratypes. CZECHOSLOVAKIA: Bohemia, Krkonoše Mts, Dolní Malá Úpa, 1 ♀, 8.ix.1968 (*Bouček*); Slovakia, Ulič-Stionka, 1 ♂ (allotype), 18.viii.1957 (*L. Masner*).

Two European species were previously known and the new species may be separated from them mainly on the following characters.

1 Median area of propodeum in both sexes rather shiny, with some diverging rugae, nearly smooth posteriorly in the depression in front of nuchal strip; the latter trapezoidal, its highly carinaceous sides hardly shorter than length of the strip in the middle. ♂: smooth strip behind eyes very broad, reaching from mouth over temples and vertex forward on frons beyond level of front edge of median ocellus, dorsally strip as broad as POL.
Pronotum distinctly narrower than the mesoscutum. Length of body 2·3–3 mm . . . . ***montana*** sp. n. (p. 303)

– Median area of propodeum dull, punctured-reticulate; nucha either not set off posteriorly by a sharp cross-carina (*P. congrua*) or the nuchal strip is in form of a low triangle and pronotum is scarcely narrower than mesoscutum (*P. discus*). In ♂ the smooth postocular strip either much shorter or, if reaching vertex, much narrower than above 2

2 (1) For separation of *P. congrua* and *P. discus* see Graham (1969 : 701).

Both *Peridesmia congrua* (Walker) and *P. discus* (Walker) are not uncommon in Czechoslovakia, but no new information on their biology is available. *P. discus* is known to me also from YUGOSLAVIA: Kopaonik Mts, Milanov Vrh, 24.viii.1958 (*Janković*).

SPANIOPUS Walker

(Text-figs 46–55)

Spaniopus Walker, 1833 : 466. Type-species: *Spaniopus dissimilis* Walker, by monotypy.

For synonymy and references see Graham, 1969.

Graham (1969 : 702–707) keyed out females of two species and males of four species. The mostly fresh material at my disposal contains seven European species, two of which have proved new to science.

KEY TO EUROPEAN SPECIES

Females

1 Eyes relatively small; in facial view width of frons about twice the height of eye, about equal to height of head (Text-fig. 58). Fore wing usually with several dispersed spots (Text-fig. 57); marginal vein about twice as long as the stigmal . . . . **polyspilus** Graham (p. 307)

– Eyes larger; frons in facial view distinctly narrower than height of head. Fore wing markings otherwise or missing; marginal vein only rarely twice as long as the stigmal, mostly shorter 2

2 (1) Body relatively slender; thorax 1·6–1·67 times as long (from anterior edge of collar) as breadth of mesoscutum; gaster 1·72–2·1 times as long as broad, sublanceolate, sides of sixth tergite converging at an angle less than 50°. Notauli distinct as impressed lines along about 3/4 of mesoscutum. Fore wing usually with one lunate macula below (but not touching) stigmal vein (Text-fig. 62), sometimes with another faint subapical spot. Associated with *Phragmites* . . . . **peisonis** (Erdös) (p. 307)

– Body stouter; thorax 1·45–1·57 times as long as broad; gaster shorter, ovate-acuminate, sides of sixth tergite converging at an angle of about 60° or more. Notauli not reaching beyond 0·6 along mesoscutum. Fore wing, if spots distinct, differently marked. Probably never associated with *Phragmites* . 3

3 (2) Antennal pedicellus dorsally fully twice as long as broad, first funicle segment fully 1·5 times as long as broad and distinctly constricted basally; whole antenna fulvous. Marginal vein often more than 1·75 times as long as the stigmal vein. Fore wing, if infumate, with a broad cloud below marginal and stigmal vein 4

– Pedicellus at most 1·8 times as long as broad, first funicle segment at most 1·3 times as long as broad, differing little in length from distal funicle segments; flagellum at least partly fuscous. Marginal vein at most 1·75 times as long as the stigmal vein. Fore wing markings different (or missing) 5

4 (3) Fifth funicle segment subquadrate, the sixth subtransverse; flagellum less strongly clavate, combined with pedicellus about as long as width of head. Fore wings larger, distinctly exceeding apex of gaster; marginal vein about 1·75 times as long as the stigmal, about 1·5 times as long as the postmarginal which is strongly tapering apically; angle between inner margins of postmarginal and stigmal veins about 50° . . ***monospilus*** (Thomson) (p. 310)

– Fifth and sixth funicle segments considerably transverse, flagellum more clavate (Text-fig. 49), its length combined with pedicellus only about 0·9 times the width of head. Fore wing smaller, about reaching apex of gaster; marginal vein about twice as long as the stigmal, about 1·8 times as long as the postmarginal, the latter vein rather broad; angle between the two veins relatively broader (Text-fig. 51) . . . . . . ***fulvicornis*** sp. n. (p. 309)

5 (3) Basal cell of fore wing extensively hairy. Funicle segments subequal in length, the third and fourth fuscous, the others yellowish; cava infuscate. In the only known female wings hyaline, but similar infumation as in male holotype, broadly appended to the veins, may be expected . ***varicornis*** sp. n. (p. 310)

– Basal cell bare but sometimes bordered distally with a few hairs on basal and cubital fold. Funicle segments more distinctly decreasing in length, the distal ones never paler than the middle ones. Fore wing, if clouded, on the disc with an obliquely oval spot, not touching the veins 6

6 (5) Flagellum all fuscous or hardly paler basally, very weakly clavate.
dissimilis Walker (p. 313)

– Funicle segments 1–4 usually paler brown, apex of flagellum blackish and slightly more clavate than above . . . . . ***amoenus*** Förster (p. 312)

Males

1 Mid tibia at least partly infuscate and more or less broadened, flattened (Text-figs 56, 60, 61) 2

– Mid tibia all yellow and not distinctly enlarged 5

2 (1) Funicle segments alternately small and large (Text-fig. 47), the large ones partly brown, the small ones mainly pale yellow. Genae in facial view with a long comb of long white hairs (Text-fig. 46). Mid tibia with a broad external lobe (Text-fig. 56) . . . . ***monospilus*** (Thomson) (p. 310)

– Funicle segments hardly different in width, not alternating in colour. Genae with shorter hairs. Mid tibia more gradually broadened distally 3

3 (2) Funicle segments 3 and 4 and clava distinctly infuscate, whilst funicle segments 1–2 and 5–6 are yellow (Text-fig. 54). Flattening of mid tibia forms two waves on inner edge and one wave subapically on the outer edge (Text-fig. 61). Fore wing extensively infuscate in the middle, infuscation adhering broadly to marginal and stigmal vein . . . . . . ***varicornis*** sp. n. (p. 310)

– Distal funicle segments not paler-coloured than the middle ones. Mid tibia on inner side enlarged in a simple curve or almost straight. Fore wing infuscation, if present, less extensive and not adhering to the veins 4

4 (3) Flagellum slender-filiform, along with pedicellus uniformly brownish testaceous (Text-fig. 55), distinctly darker than the pale yellow scape. Gena below with outstanding hairs which are about twice as long as the hairs on face below antennae. Mid tibia in dorsal view with inner side all blackish, more broadly flattened than the outer side. Eye longer than scapus. ***dissimilis*** Walker (p. 313)

– Flagellum subclavate, basally pale yellow, funicle segments 5 and 6 and clava fuscous. Gena below only with normal hairs which are subequal to those on lower face. Mid tibia in dorsal view with only the outer side flattened, the inner side usually with a pale line throughout (Text-fig. 60). Eye about as long as scapus . . . . **amoenus** Förster (p. 312)

5 (1) Head more strongly transverse than in the alternate
Here probably the unknown male of ***S. polyspilus*** Graham

– Head in dorsal view 1·78–1·96 times as broad as long, in facial view 1·21–1·29 times as broad as high 6

6 (5) Fifth and sixth funicle segment subquadrate (Text-fig. 50); flagellum hardly longer than width of head, its segments uniformly flavous. Eye about 1·25 times as long as broad, about 1·8 times as long as malar space. Scapus in lateral view hardly broader than the funicle. Thorax fairly arched dorsally. Apex of basal cell of fore wing more or less hairy. Possibly not associated with *Phragmites* . . . . ***fulvicornis*** sp. n. (p. 319)

– Fifth and sixth funicle segment distinctly elongate; flagellum itself about 1·1 times as long as width of head, funicle segments partly and rather irregularly pale testaceous and partly brownish; scapus in side view at least 1·3 times as broad as the funicle. Thorax very weakly arched dorsally. Basal cell of fore wing bare. Associated with *Phragmites* . . ***peisonis*** (Erdös) (p. 317)

Spaniopus polyspilus Graham

(Text-figs 52, 57–59)

[*Polycelis conspersa* (Walker); Thomson, 1878 : 143–144. Misidentification.]
Spaniopus polyspilus Graham, 1956 : 251. Holotype ♀, SWEDEN: Stockholm (UZI, Lund) [examined]. [Proposed as new name for *Polycelis conspersa* (Walker) sensu Thomson, 1878.]

This species is not conspecific with *Spaniopus peisonis* (Erdös) as Graham (1969) assumed, but a valid species the main characters of which are given in the key above.

BIOLOGY still unknown.

Known so far only from SWEDEN (Thomson's specimens).

Spaniopus peisonis (Erdös)

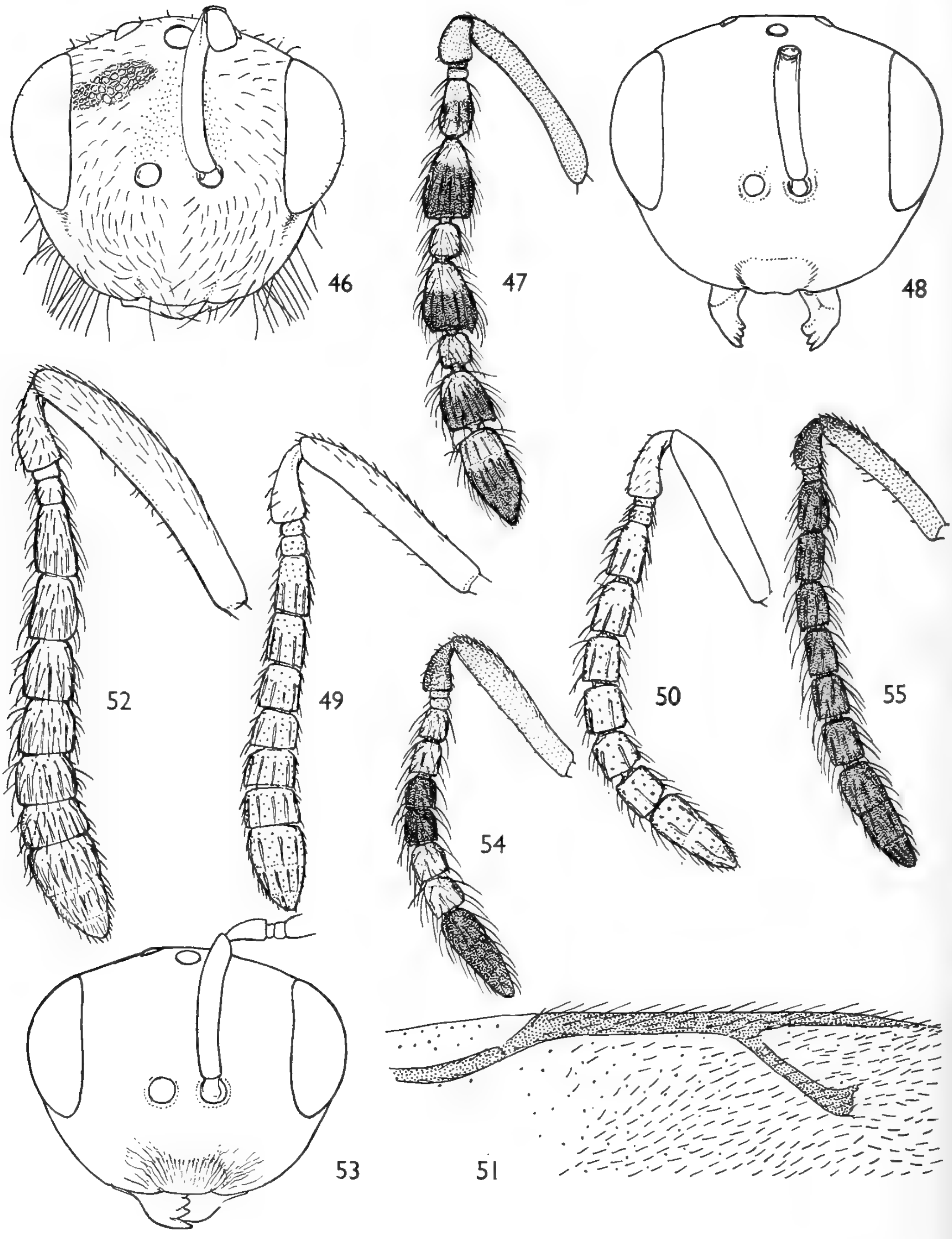
(Text-figs 53, 62)

[*Polycelis monospila* Thomson, 1878 : 145, ex parte (only ♀, not the lectotype).]
Gyrinophagus peisonis Erdös, 1957 : 64, ♂♀. Holotype ♀, HUNGARY: Vörs (TM, Budapest) [examined].

I examined the Hungarian material including the holotype several years ago in Dr Erdös' collection.

BIOLOGY. Parasite in the galls of *Giraudiella inclusa* (Frauenfeld) (Dipt., Cecidomyiidae) on *Phragmites communis* Trin.

DISTRIBUTION. Britain, Sweden, Czechoslovakia, Hungary.



FIGS 46–55. *Spaniopus*. 46–47. *S. monospilus*. 46, ♂ head; 47, ♂ antenna. 48–51. *S. fulvicornis*. 48, ♀ head; 49, ♀ antenna; 50, ♂ antenna; 51, fore wing venation in ♀. 52. *S. polyspilus*, ♀ antenna. 53. *S. peisonis*, ♀ head. 54. *S. varicornis*, ♂ antenna. 55, *S. dissimilis*. ♂ antenna.

MATERIAL EXAMINED.

Type-data given in synonymy.

SWEDEN: Småland, 3 ♀ paralectotypes of *P. monospila* Thomson (*Boheman*); coll. Thomson, UZI, Lund; Skåne, Yddingen, 1 ♀ (*Graham*); Graham Coll. CZECHOSLOVAKIA: Bohemia, Břehyně near Doksy, 3 ♀, 17.vii.1963 (*Bouček*); Kokořín, ex *Giraudiella inclusa*, 2 ♂, vi.1958 (*M. Skuhravá*); Týniště nad Orlicí, 3 ♂, 16 ♀, viii.1959, 1 ♂, 23.vii.1955 (*Bouček*); Soběslav, 14 ♀, 22.vii.1955 (*Hoffer*); Moravia, Branišovice S. of Brno, 1 ♀, 29.v.1956 (*Bouček*); Slovakia, Turna nad Bodvou, 1 ♀, 23.iv.1952 (*Bouček*).

Spaniopus fulvicornis sp. n.

(Text-figs 48–51)

♀. Metallic green, on vertex and thoracic dorsum slightly merging with dark cupreous, gaster darker green; antenna testaceous, apically often slightly darker than basally, also pedicellus sometimes slightly infuscate; legs testaceous but coxae basally mainly dark and with metallic tinge, apex of tarsi infuscate. Wings hyaline but fore wing usually with fuscous cloud attached broadly to marginal and stigmal vein; venation testaceous. Length 1·9–2·9 (holotype 2·6) mm.

Head dorsally fully twice as broad as long (49 : 24), 1·24 times as broad as mesoscutum and 1·49 times as broad as pronotum; temple about one-third length of eye in dorsal view. POL to OOL as 4 : 3. Relative measurements: breadth of head 49, height 40, breadth of frons 33, eye 24 : 17, malar space 13, width of mouth 23, scapus length 20·5, flagellum plus pedicellus 43, i.e., 0·88 the breadth of head. Left mandible 3, right 4 teeth. Clypeus and lower face densely radiately striate, lower margin of clypeus subemarginate. Scapus not quite reaching vertex level, slender, bent (Text-fig. 49). Pedicellus dorsally 2–2·1 times as long as broad; second anellus only slightly transverse (as in *S. polyspilus*); funicle segments distinctly decreasing in length and increasing in width, the first in some views narrower than pedicellus and about 1·5 times as long as broad, the sixth in lateral view 1·5 times as broad as pedicellus and 1·5 times as broad as long; clava barely longer than two preceding segments combined.

Length of thorax measured from anterior edge of collar 1·53 times the breadth of mesoscutum. Collar moderately sloping, medially 0·22 the length of mesoscutum. Scutellum with rather deep reticulation-puncturation. Propodeum medially two-thirds the length of scutellum, nucha taking up posterior 3/7; median area rather dull, irregularly reticulate-punctured, as broad as median length of propodeum. Plicae distinct, almost regularly arcuate; part beyond plicae densely clothed with white hairs, except area around spiracle. Upper mesepimeron smooth. Hind femur 4·5 times as long as broad. *Fore wing:* relative lengths of veins: marginal 22, postmarginal 13, stigmal vein 11, the latter at a relatively wide angle (Text-fig. 51). Basal cell with adjoining folds bare, basal fold sometimes with 1–2 hairs; lower surface of costal cell basally with single hair-line.

Gaster barely as long as head plus thorax combined, ovate-acuminate, itself 1·66–1·85 times as long as broad, sides of sixth tergite converging at about 60°.

♂. Similar to female in colour and in form of thorax. Antennae and legs yellowish testaceous. Scapus slightly exceeding vertex level, as long as eye (in one specimen slightly shorter than eye). Flagellum (Text-fig. 50) plus pedicellus about 1·1 times as long as head width; pedicellus dorsally 1·8 times as long as broad; flagellum feebly clavate, unicolorous, first funicle segment about 1·5 times as long as broad, the sixth subquadrate; clava about 2·5 times as long as broad, subacuminate. Genae without outstanding hairs. Mid tibia simple and not infuscate. *Fore wing* subhyaline, with basal cell slightly hairy in distal part; marginal vein about 1·8 times (1·75–1·89 times) as long as the stigmal. Gaster slightly longer than half length of thorax. Length of body 1·5–1·6 mm.

BIOLOGY unknown. Probably a grass-dweller.

Holotype ♀. CZECHOSLOVAKIA: Bohemia, Sedlo Hill near Litoměřice, 6.viii.1964 (*Bouček*); presented to BMNH, London.

Paratypes. CZECHOSLOVAKIA: Bohemia, Mt. Děčínský Sněžník, 2 ♀, 1 ♂, 27.vii. 1956 (*Bouček*); Bělá near Děčín, 3 ♀, 2 ♂ (one of them allotype), 20.viii.1956 (*Bouček*); Břehyně near Doksy, 1 ♀, 21.vii.1963 (*Strejček*); Jedlová Mt., near Rumburk, 1 ♀, 8.v.1960 (*Bouček*); Slovakia, Smokovec, High Tatra Mts, 1 ♀, 21.viii.1958 (*Bouček*). Paratypes partly in NM, Prague, partly in Bouček Collection.

Spaniopus monospilus (Thomson)

(Text-figs 46, 47, 56)

Polycelis monospila Thomson, 1878 : 145. Lectotype ♂, SWEDEN: Kinekülle (UZI, Lund) [examined].

Polyscelis Websteri Ashmead, 1894: 52–53, ♀♂. Holotype ♀, U.S.A.: Indiana, Lafayette (USNM, Washington) [examined]. **Syn. n.**

P. websteri is a synonym of *S. monospilus* as Graham (1969 : 706) has already suggested. In October 1970 I showed the very distinctive lectotype male of *monospilus* to Dr Burks and he agreed with the synonymy. More recently he kindly sent to me for examination the holotype of *websteri*. Because the females referred to *S. monospilus* by Thomson proved to belong to *S. peisonis* (see under that species), the holotype of *websteri* is the only known female of the present species. Its characters are included in the key above.

BIOLOGY not known with certainty. *P. websteri* was recorded from a Cynipid gall on *Lactuca canadensis* (Peck, 1963), which seems doubtful (Dr B. D. Burks, personal communication).

DISTRIBUTION: Sweden (only 2 males); U.S.A.

Spaniopus varicornis **sp. n.**

(Text-figs 54, 61)

♀. Mainly metallic green, but vertex dark purple to violaceous or bronzy, thoracic dorsum with dull cupreous to bronzy tinge, gaster bluish green with bright green base. Antenna testaceous with funicle segments 3 and 4 fuscous; weakly infuscate, mainly dorsally, are also pedicellus, second and fifth funicle segment; clava fuscous. Wings hyaline, venation testaceous. Length 2 mm.

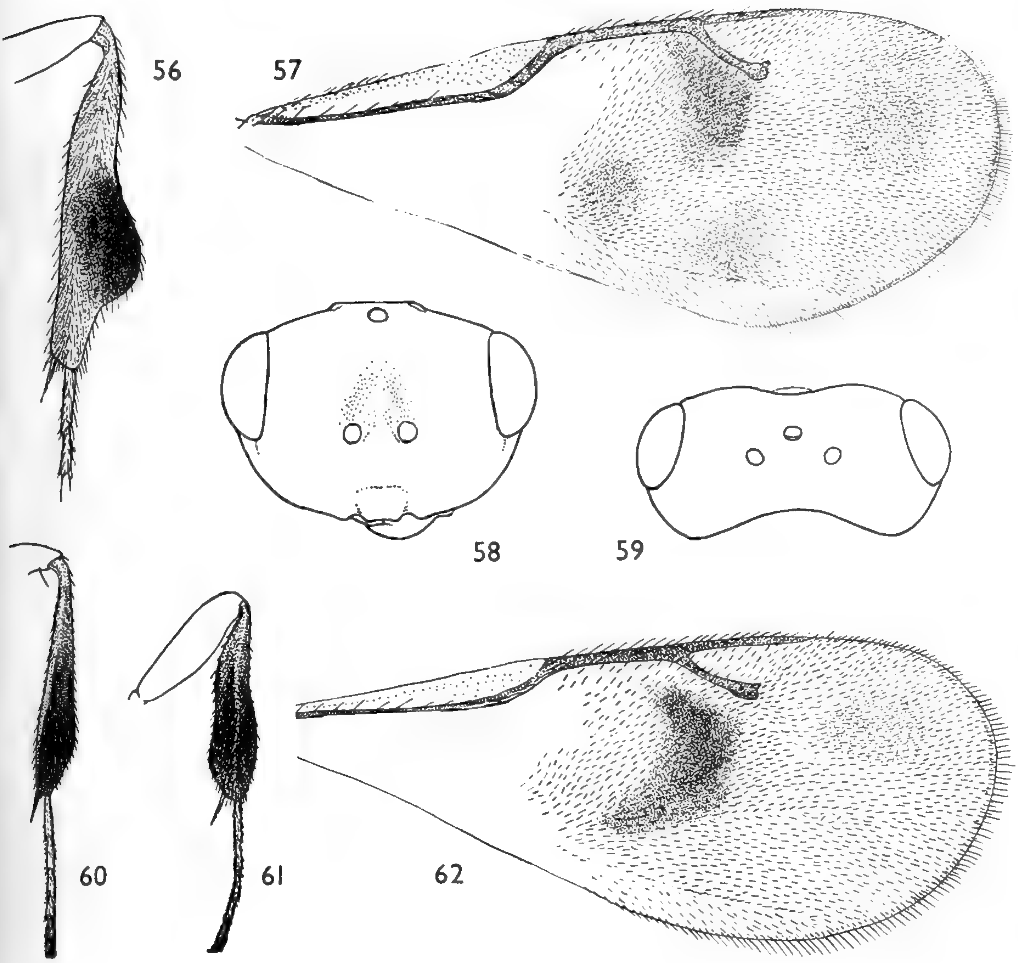
Head dorsally twice as broad as long, 1·26 times as broad as mesoscutum 1·53 times as broad as pronotum; temple one-third the length of eye. POL 1·4 times the OOL In facial view head 1·26 times as broad as high, with genae strongly converging (at about 120°). Lower face very distinctly radiately striate, lower margin of clypeus shallowly depressed, subemarginate. Scapus reaching to level with anterior edge of median ocellus; pedicellus dorsally about 1·8 times as long as broad; flagellum plus pedicellus as long as 0·9 the breadth of head; both anelli together about as long as broad; flagellum in lateral view slightly clavate, clothed with semi-erect hairs almost half as long as segments; all funicle segments subequal in lengths, in lateral

view the first slightly elongate, the sixth slightly transverse; clava fully twice as long as broad.

Thorax almost as in male. Legs normal, not very slender, hind femur about 4·3 times as long as broad, hind tarsus 0·7 the length of tibia. *Fore wing* with basal cell extensively hairy. Relative lengths of veins: marginal 12·5, postmarginal 12, stigmal vein 11.

Gaster ovate-pointed, slightly longer than thorax, itself 1·62 times as long as broad; in dorsal view sides of sixth tergite converging at angle of about 80°.

♂. Bright green with weak brassy reflections on frons and thoracic dorsum. Antenna pale yellow, but funicle segments 3 and 4 fuscous; apex of scapus, pedicellus and clava except apex also infuscate (Text-fig. 54). Tegulae and legs including coxae pale testaceous, but mid



FIGS 56–62. *Spaniopus*. 56. *S. monospilus*, mid tibia in ♂. 57–59. *S. polyspilus*. 57, fore wing in ♀; 58 & 59, ♀ head in facial and dorsal view. 60. *S. amoenus*, mid tibia of ♂. 61. *S. varicornis*, mid tibia of ♂. 62. *S. peisonis*, fore wing of ♀ with well developed markings.

tibia fuscous except basally (Text-fig. 61). Fore wing with broad brownish cloud attached to marginal and stigmal vein. Length 1·6 mm.

Head dorsally 1·91 times as broad as long, eye 3·3 times as long as temple; POL 1·5 times the OOL. In facial view head 1·24 times as broad as high. Lower face more distinctly, clypeus more finely and shallowly, radiately striate, in middle below smooth; lower margin subemarginate. Mandibles: left 3, right 4 teeth. Genae arched, strongly converging, below with group of erect white hairs of medium length. Relative measurements: breadth of head 34, frons 22, eye 17·2 : 13, malar space 7, width of mouth 15·4, length of scape 15·5, flagellum plus pedicellus about 46, i.e., 1·36 times the breadth of head. Pedicellus dorsally 1·7 times as long as broad; both anelli transverse, together hardly as long as broad; funicle segments (Text-fig. 54) subequal in length, hardly increasing in breadth, the basal ones inconspicuously longer than broad, the distal ones subquadrate; clava slightly shorter than three preceding segments together; flagellum with semidistant hairs slightly shorter than segments.

Pronotum moderately narrower than mesoscutum, rather deeply emarginate posteriorly, collar anteriorly angulate, in middle about 1/6 the length of mesoscutum. The latter hardly more than 1·5 times as broad as long; notauli fading out in the middle. Propodeum 0·78 the length of scutellum, median area about 1·1 times as broad as long, anteriorly less coarsely more than 1·5 times as broad as long; notauli fading out in the middle. Propodeum 0·78 the reticulate than on nucha. Plicae distinct but not sharp; small oval spiracle nearly two diameters from metanotal margin; lateral part of propodeum beyond spiracle and beyond posterior half of plica densely hairy. Legs rather strong: femora slightly thickened, also fore tibia which is in side view only 5·3 times as long as broad. Mid tibia (Text-fig. 61) flattened, in dorsal view externally enlarged only in distal half, internally both in basal and distal halves, in outline there forming double curve. Mid femur 4 times as long as broad. *Fore wing* with basal cell hairy all over. Relative lengths of veins: marginal 15, postmarginal 12, stigmal 9·5.

Gaster subrotund, broader and shorter than thorax. Petiole conspicuous, smooth, in middle slightly broader than long, sides anteriorly parallel. First tergite covering more than half of gaster, its hind margin arcuate.

BIOLOGY not known.

Holotype ♂. CZECHOSLOVAKIA: Slovakia, Smokovec in High Tatra Mts, 29.viii. 1958 (*Bouček*); in Bouček Collection.

Paratype. CZECHOSLOVAKIA: Bohemia, Týniště nad Orlicí, 1 ♀ (allotype), 12.ix.1959 (*Hoffer*); in Graham Collection.

The absence of the fore wing infumation in the allotype may be due to the subteneral condition of the specimen.

Spaniopus amoenus Förster

(Text-fig. 60)

Spaniopus amoenus Förster, 1856 : 56. Type ♂, GERMANY: ?Aachen (?lost).

The type-material is probably lost but the short description fits the fresh material well. The female was not then known. It is extremely similar to that of *Spaniopus dissimilis* Walker and except for the colour of the antenna in most specimens (which, however, does not always seem to be reliable) I cannot find any additional character. Various parts of the body which are likely to yield some difference were measured and show a rather wide range of variation. Length of scape in relation

to the long eye diameter varies from 0·91–1·0 (: 1), while in *S. dissimilis* the same relation shows figures between 0·85 and 0·93. Similar overlap has been found in the relative length of malar space and of the veins in the fore wing. Length of body 1·8–2·4 mm.

BIOLOGY not known, but the species seems to be associated with grasses in xerothermic habitats.

DISTRIBUTION. France, W. and E. Germany, Czechoslovakia, Hungary.

MATERIAL EXAMINED.

FRANCE: Finisterre, Huelgoat, 2 ♀, 29.v.1954 (*J. F. Perkins*), in BMNH. E. GERMANY: Dresden district, 1 ♂, 16.ix.1965 (*Strejček*). CZECHOSLOVAKIA: Bohemia, Džbán Hill, 3 ♀, 2 ♂, 4.ix.1966 (*Bouček*); Velký Vřeštov, 1 ♂, viii.1961 (*Bouček*); Slovakia, Slanec, incl. Lake Izra and Helmec Valley, 6 ♀, 1 ♂, 3.–6.viii.1954 (*Bouček & Dlabola*). HUNGARY: Mecsek Hills, Misina, sifting under heath, about 80 ♀ and several ♂♂, 24.x.1953 (*Kaszab*); Budapest-Hüvösvölgy, 1 ♀, 2 ♂, vi.–ix.1927 (*Biró*), the Hungarian material mostly in TM, Budapest.

Spaniopus dissimilis Walker

(Text-fig. 55)

Spaniopus dissimilis Walker, 1833 : 466. Holotype ♂, BRITAIN: near London (BMNH) [examined].
Spaniopus elegans Förster, 1856 : 56. Holotype ♂, W. GERMANY: (?) Aachen (?lost). **Syn. n.**
Polyscelis modestus Gahan, 1922 : 11–12, ♀♂. Holotype ♀, U.S.A.: Pennsylvania, Hannover (USNM, Washington).

Graham (1969 : 705) is probably right in regarding *P. modestus* as a synonym of *S. dissimilis*, although the figure 16D in Gahan, 1933, shows the mid tibia of the male a little too slender. From the material examined I conclude that also *S. elegans* Förster, although its type seems to be lost, must be the same species. The flagellum of the male is usually brownish, but sometimes paler, yellowish, as described for *S. elegans*.

BIOLOGY. Solitary ectoparasite of *Mayetiola destructor* (Say) (Dipt., Cecidomyiidae) in grass stems, including wheat; mostly primary, rarely secondary (Gahan, 1922, 1933). According to my experience, unlike the closely related *S. amoenus*, *S. dissimilis* is not associated with xerothermic habitats.

DISTRIBUTION. Ireland, Britain, Sweden, Czechoslovakia; Canada, U.S.A.

NEW RECORDS.

BRITAIN: Ross-shire, Black Isle, 1 ♀, vii.1951 (*N. Hussey*). SWEDEN: Skåne, Fjellfota sjö, 1 ♀, 1 ♂, 31.vii.1938 (*J. F. Perkins*); Degaberga, 1 ♂, 8.vii.1938 (*D. M. S. P. & J. F. P.*); both in BMNH. CZECHOSLOVAKIA: Bohemia: Bělá near Děčín, 1 ♂, 14.vi.1957 (*Bouček*); Břehyně near Doksy, 2 ♀, 1 ♂, 12.vii.1959 (*Bouček*); Týniště nad Orlicí, 1 ♂, 23.vii.1955 (*Bouček*); partly in NM, Prague.

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—— 1965. Some interesting records of Chalcid flies from Great Britain, with the description of *Bugacia classeyi* n. sp. (Hymenoptera: Pteromalidae). *Entomologist's Gaz.* **16** : 83–86, 4 figs.

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B. BOLTON

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BY

BARRY BOLTON

Pp. 317–368; 1 *Text-figure*

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By B. BOLTON

CONTENTS

SYNOPSIS

Keys are given to the subfamilies and genera of ants present in West Africa. A synopsis of the known generic synonymy is presented along with diagnostic notes on the genera.

INTRODUCTION

West Africa, in the sense of the present study, includes the territories of Senegal, Gambia, Portugese Guinea, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Dahomey, Nigeria, Upper Volta, and the southern portions of Mali and Niger (below 15° N.).

Two distinct types of vegetation occur in the above states, forest and savannah. The forest zone forms a belt of varying width running parallel to the coast, sometimes coming very close to the sea but often separated from the ocean by a coastal plain. The forest zone is not represented in the inland states of Upper Volta, Mali and Niger. North of the forest zone is the inland savannah belt which grades into the Sahara Desert. In places, such as the Dahomey forest gap, the savannah reaches to the coast and the ant fauna of the coastal plains bears a greater resemblance to the savannah than to the forest population.

As defined above, West Africa is bounded on the west and south by the Atlantic Ocean, on the north by the steppe region which grades into the Sahara Desert, and on the east by the mountain ranges of Cameroun.

The majority of ant genera in West Africa contain species in both the forest and savannah zones, but some genera are confined to the forest (e.g. *Psalidomyrex* E. André) whilst others are restricted to the savannah and the coastal plains (e.g. *Messor* Forel, *Cataglyphis* Förster).

Wheeler (1922) included keys to the world genera of ants and a check list of the ants of the Ethiopian Region in the monumental 'Ants of the Belgian Congo'. These keys are now considerably outdated due to revisions, synonymies and descriptions of new genera carried out since the publications of this study, and are now unworkable in many places.

The first section of the present paper gives keys to the subfamilies and genera of ants recognized at present from West Africa, and includes some pantropical tramp ants such as *Trichoscapa* Emery, which have not yet been reported but can be expected to be found in the region. In the second section the genera are arranged under their appropriate subfamilial and tribal groupings, and the known synonyms up to the time of writing are included, as are short diagnostic notes on the genera. An indication of nesting sites and habits are given where these are known.

ACKNOWLEDGEMENTS

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DEFINITIONS OF SOME CHARACTERS USED IN THE KEYS

(See also Text-fig. 1)

Acidopore: a circular or subcircular orifice formed by the apex of the hypopygium in the subfamily Formicinae, the orifice of the acid-producing glands. Usually the acidopore is visible at the apex of the gaster, sometimes borne on a conical projection of the hypopygium but occasionally concealed by the pygidium when not in use. (Hung & Brown, 1966).

Alitrunk (= *mesosoma*)*:* the thorax proper plus the propodeum (first true abdominal segment) to which it is fused in the higher Hymenoptera. The 'thorax' of older authors.

Antennal Scrobe: a longitudinal depression in the side of the head, either above or below the eye, which can accommodate the scape or the whole of the antenna.

Frontal Carinae: a pair of longitudinal ridges situated mediodorsally on the head behind the clypeus. Usually the frontal carinae are expanded laterally into lobes which cover the antennal insertions.

Funiculus (= *flagellum*)*:* collective term for all the antennal segments distal to the elongated first segment or scape.

Gaster: the four or five visible remaining abdominal segments situated behind the separated pedicellar segments, and forming the apparent 'abdomen'.

Hypopygium: the last visible gastral sternite (bearing the acidopore in the subfamily Formicinae). In reality the sternite of the seventh abdominal segment.

Palp Formula: the number of segments in the maxillary and labial palpi, always expressed in the order maxillary, labial. (e.g. palp formula 6,4.)

Pedicel: the one or two separated abdominal segments between the alitrunk (apparent thorax) and gaster (apparent abdomen). The first segment is termed the *petiole,* the second when present the *postpetiole.* In reality the second and third (when present) true abdominal segments.

Petiole and *Postpetiole:* see *Pedicel,* above.

Propodeum (= *epinotum*)*:* the first true abdominal segment, fused to the thorax proper to form the *alitrunk.*

Psammophore: a basket-like arrangement of long setae found on the gular surface of the head in deserticolous ants and used to transport grains of soil.

Pygidium: the last visible gastral tergite. In reality the tergite of the seventh true abdominal segment.

Scape: the elongate first segment of the antenna.

Keys to the Subfamilies of FORMICIDAE in West Africa
(based on worker caste)

1 Pedicel of a single segment, usually with a narrow connection to the gaster so that the petiole has a distinct posterior face. Rarely the petiole is reduced or very broadly attached to the gaster 2

– Pedicel of two segments, usually with the postpetiole distinctly separated from the gaster. Rarely the postpetiole is broadly attached to the gaster, but in this case the antennae are only 6-segmented 6

2 Eyes absent. Clypeus reduced so that the antennal insertions are very close to the anterior margin of the head. Frontal carinae raised, leaving the condylar bulbs of the antennae visible in dorsal view. Pygidium impressed, armed with a spine or tooth at each side posteriorly. Promesonotal suture distinct, mobile. Lateral alitrunk in large and medium workers with a distinct, deep longitudinal impression below the propodeal spiracle. Sting reduced, non-functional. Polymorphic. (Driver Ants) . . . . **DORYLINAE** (p. 328)

– Without all the above characters. Eyes usually present; clypeus developed so that the antennal insertions are some distance behind the anterior margin of the head. Frontal carinae usually at least partially cover antennal insertions; if not, then the dorsum of the alitrunk is without sutures. Pygidium rarely impressed; alitrunk laterally without a deep impression below the propodeal spiracle 3

3 Sting well developed, functional. (Usually visible in alcohol-killed or mounted specimens) 4

– Sting vestigial or absent, never visible 5

4 Pygidium impressed, armed laterally or posteriorly with a row of short denticles or spines (which may be difficult to see due to setal development). Genae carinate. Frontal carinae fail to cover condylar bulbs of antennae. Alitrunk dorsally completely devoid of sutures, or sutures represented by weak impressions at most **CERAPACHYINAE** (p. 325)

– Pygidium never impressed, never armed with spines or denticles. Genae usually not carinate; frontal carinae usually cover condylar bulbs of antennae. Alitrunk

dorsally usually with at least one suture; if sutures absent, then the second gastral segment is strongly vaulted . . . . **PONERINAE** (p. 323)

5 Apex of gaster with a circular acidopore formed from the hypopygium, this structure often projecting as a nozzle and fringed with setae. Occasionally the orifice of the acidopore is hidden by a projection of the pygidium, in which case the pronotum, petiole or both armed with spines. Petiole usually a scale or node, rarely reduced **FORMICINAE** (p. 329)

– Acidopore absent, the gaster terminating in a transverse slit bounded by the pygidium and hypopygium. Petiole usually reduced and overhung by the first gastral segment, rendering the petiole invisible in dorsal views. **DOLICHODERINAE** (p. 329)

6 Pygidium impressed and armed laterally or posteriorly with a row of short spines or denticles (which may be difficult to see due to setal development) **CERAPACHYINAE** (p. 325)

– Pygidium not impressed, not armed with teeth or denticles. 7

7 Frontal carinae vertical, failing to cover the antennal insertions; eyes absent . . 8

– Frontal carinae not vertical, totally or partially covering the antennal insertions; eyes usually present 9

8 Antennae 10-segmented; genae carinate. Larger ants with head width greater than 0·25 mm . . . . **DORYLINAE** (p. 328)

– Antennae 12-segmented; genae not carinate. Minute ants with head width less than 0·25 mm . . . . **LEPTANILLINAE** (p. 328)

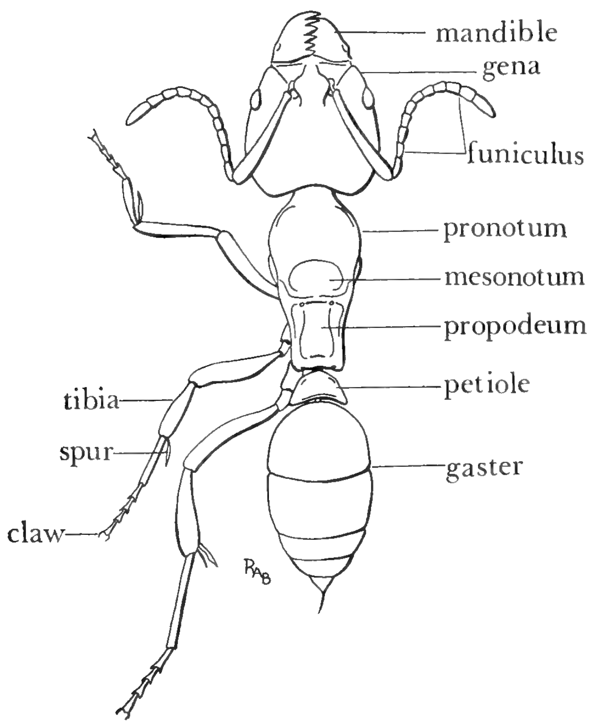

FIG. 1. Worker of *Brachyponera senaarensis* (Mayr), to illustrate some terms used in the key.

9 Clypeus projecting back between the frontal carinae. Tibial spurs of middle and hind legs usually simple or absent; if pectinate a psammophore is present on the gular surface of the head. Antennae 4- to 12-segmented. Eyes usually medium to small in size, ocelli absent. Claws simple . . **MYRMICINAE** (p. 325)

– Clypeus not projecting back between frontal carinae. Tibial spurs of middle and hind legs pectinate. Psammophore absent. Antennae always 12-segmented. Eyes usually large, ocelli often present. Claws usually toothed **PSEUDOMYRMECINAE** (p. 329)

Keys to the Genera
(based on worker caste)
Subfamily PONERINAE

1 Petiole broadly attached to first gastral segment, without a free posterior face. Mandibles elongate and narrow, dentate down the entire inner margin . . 2

– Petiolar-gastral junction narrow, petiole usually with a distinct free posterior face. Mandibles not as above; if elongate they are either not dentate down the entire inner margin or are not narrow 3

2 Mandibles pointed at apex, not as long as head; tooth row on inner margin single. Sculpture fine, spatulate hairs absent . . ***AMBLYOPONE*** Erichson (p. 330)

– Mandibles blunt at apex, very long (longer than head), with a double tooth-row on the inner margin. Sculpture coarse, spatulate hairs present ***MYSTRIUM*** Roger (p. 331)

3 Tergite of second gastral segment strongly vaulted so that the remaining segments point anteriorly. Alitrunk devoid of sutures 4

– Tergite of second gastral segment not strongly vaulted, remaining segments directed posteriorly. Alitrunk usually with at least one suture visible dorsally . . 5

4 Mandibles edentate, overhung by the projecting clypeus. Apical funicular segment bulbous . . . . ***DISCOTHYREA*** Roger (p. 332)

– Mandibles with three teeth, not overhung by clypeus. Apical funicular segment only moderately enlarged . . . . . . ***PROCERATIUM*** Roger (p 333)

5 Mandibles linear, inserted in the middle of the anterior margin of the head, with an apical armament of three teeth arranged in a vertical series 6

– Mandibles inserted at sides of anterior margin of head, not armed apically with a vertical series of three teeth 7

6 Dorsalmost tooth of apical mandibular series acute . ***ANOCHETUS*** Mayr (p. 333)

– Dorsalmost tooth of apical mandibular series truncated. ***ODONTOMACHUS*** Latreille (p. 333)

7 Claws pectinate (incompletely so in some species).
Clypeus carinate, projecting as a lobe or point antero-medially. Mandibles inserted at extreme corners of anterior margin of head, either edentate or nearly so ***LEPTOGENYS*** Roger (p. 337)

– Claws simple or with a tooth, never pectinate 8

8 Middle tibiae and tarsi with abundant downcurved spines and stiff hairs on the outer surface, giving a brush-like appearance. Tibial spurs of middle legs both small and simple, hind tibiae with a large pectinate and a small simple spur. Eyes absent . . . . ***CENTROMYRMEX*** Mayr (p. 335)

– Middle tibiae and tarsi not as above. Tibial spurs of middle and hind legs similarly developed. Eyes usually present 9

9 Mandibles elongate, linear, somewhat curved 10

– Mandibles triangular or subtriangular 12

10 Mandibles blunt and edentate apically, the inner margin with not more than two blunt teeth. Mandibular articulation associated with a marked semicircular excavation of the dorsal anterior margin of the head in front of the eye . . 11

– Mandibles dentate apically, their inner margins retaining feeble traces of teeth. Mandibular articulation not associated with a semicircular excavation of the anterior margin of the head . . . . ***PROMYOPIAS*** Santschi (p. 339)
11 Mandibles with distal half swollen, the inner margin without teeth ***CACOPONE*** Santschi (p. 335)
– Mandibles with distal half tapering, not swollen; inner margin with one or two blunt teeth . . . . ***PLECTROCTENA*** F. Smith (p. 339)
12 Clypeus fused to frontal carinae and forming a plate which projects forwards above the mandibles. Antennae inserted close to the anterior margin of this plate, their condylar bulbs exposed . . . . ***PROBOLOMYRMEX*** Mayr (p. 332)
– Clypeus and frontal carinae not modified as above; condylar bulbs of antennae covered by frontal carinae 13
13 Gaster without a constriction between the first and second segments 14
– Gaster with a constriction between the first and second segments. . . . 15
14 Petiole armed with a comb of five teeth which recurve over the gaster ***PHRYNOPONERA*** Wheeler (p. 338)
– Petiole a narrow, unarmed, erect scale . . ***ASPHINCTOPONE*** Santschi (p. 334)
15 Pretarsal claws armed with a tooth either medially or near base 16
– Pretarsal claws simple, without teeth 18
16 Gena with a carina running longitudinally between the eye and the mandibular articulation. Claws toothed near the base . . ***MEGAPONERA*** Mayr (p. 337)
– Gena not carinate. Claws with a median tooth 17
17 Tibiae of middle and hind legs each with two pectinate spurs. Sculpture of fine dense shagreening with associated larger punctures. Median portion of clypeus not raised nor projecting anteriorly as a lobe . . ***PLATYTHYREA*** Roger (p. 331)
– Tibiae of middle and hind legs each with one large pectinate and one small simple spur. Sculpture not as above. Median portion of clypeus abruptly raised and projecting forwards as a truncated lobe . . . ***PALTOTHYREUS*** Mayr (p. 338)
18 Middle and hind tibiae each with a single pectinate spur 19
– Middle and hind tibiae each with two spurs, one large and pectinate, the other small and simple 21
19 Basal portion of mandible with a distinct pit or fovea dorsolaterally ***CRYPTOPONE*** Emery (p. 336)
– Basal portion of mandible without a dorsolateral pit or fovea 20
20 Larger ants, total length greater than 7 mm. Mandibles elongate-falcate, their apical margins edentate or crenulate, the apex prolonged so that the tips cross over at rest . . . . . . ***PSALIDOMYRMEX*** E. André (p. 339)
– Smaller ants, total length less than 5 mm. Mandibles triangular with 3–4 enlarged teeth apically, usually followed by a row of denticles. Apical margins meet evenly when mandibles at rest . . . ***HYPOPONERA*** Santschi (p. 336)
21 Petiole thick, nodiform. Metanotal suture obsolete or absent, not impressed. Propodeum not or only slightly narrower than pronotum in dorsal view ***BOTHROPONERA*** Mayr (p. 334)
– Petiole a thick scale. Metanotal suture present, usually distinct and impressed. Propodeum narrower than pronotum in dorsal view 22
22 Basal portion of mandible with a dorsolateral pit or fovea 23
– Basal portion of mandible without a dorsolateral pit or fovea ***MESOPONERA*** Emery (p. 338)
23 Palp formula 3,3. Eyes larger, their maximum diameter greater than the greatest width of the scape. Metanotal suture very deeply impressed ***BRACHYPONERA*** Emery (p. 335)
– Palp formula 4,4. Eyes smaller, their maximum diameter less than the greatest width of the scape. Metanotal suture very weakly impressed ***TRACHYMESOPUS*** Emery (p. 340)

Subfamily CERAPACHYINAE

1 Eyes absent. Gastral segments separated from each other by distinct constrictions **_SPHINCTOMYRMEX_** Mayr (p. 341)

– Eyes present, varying from large to minute. Gaster constricted only between first and second segments, sometimes very deeply so, so that the pedicel is to all intents and purposes two-segmented 2

2 Tibial spurs absent from middle legs. Claws toothed. Antennal scapes much compressed dorsoventrally, more or less triangular in dorsal view **_SIMOPONE_** Forel (p. 341)

3 Tibial spurs present on middle legs. Claws simple. Antennal scapes not or only slightly compressed, not triangular in dorsal view 3

– Apical segment of funiculus strongly swollen, forming a one-jointed club. Petiole not marginate laterally, never armed with teeth posterodorsally **_CERAPACHYS_** F. Smith (p. 340)

– Apical three funicular segments swollen, forming a weak club. Petiole sharply marginate laterally, often with a pair of teeth situated posterodorsally **_PHYRACACES_** Emery (p. 340)

Subfamily MYRMICINAE

1 Antennae with 4 segments 2

– Antennae with 6 segments 4

– Antennae with 7 segments . . . . . **_MYRMICHRIA_** Saunders (p. 349)

– Antennae with 9 segments 11

– Antennae with 10 segments 14

– Antennae with 11 segments 17

– Antennae with 12 segments 26

2 Mandibles short, subtriangular, serially dentate. Clypeus projecting anteriorly and overhanging mandibles for most of their length. Head without specialized orbicular hairs . . . . **_MICCOSTRUMA_** Brown (p. 343)

– Mandibles elongate, linear, not serially dentate. Clypeus not projecting anteriorly over the mandibles. Head with numerous specialized orbicular hairs . . . 3

3 Apex of each mandibular blade with a fork of two spiniform teeth. Labrum not produced between mandibles as a biconical structure **_QUADRISTRUMA_** Brown (p. 344)

– Apex of each mandible with a vertical series of denticulae. Labrum produced between mandibles as a biconical structure . . . **_EPITRITUS_** Emery (p. 343)

4 Mandibles long and linear, with not more than 4 teeth on the inner margin of each blade 5

– Mandibles short, triangular or subtriangular, serially dentate or denticulate . . 7

5 Mandibles with an apical fork of 2–3 teeth, which may have one or more intercalary denticulae. Head without orbicular hairs 6

– Mandibles without apical fork; either with a single long tooth at the dorsal apex subtended by a series of denticulae or with a series of denticulae only. Head with orbicular hairs present . . . . . . **_EPITRITUS_** Emery (p. 343)

6 Antennal scrobes absent. Mandibular blades without preapical teeth. Occipital lobes of head, promesonotum, propodeum and petiole armed with teeth or short spines . . . . **_MICRODACETON_** Santschi (p. 344)

– Antennal scrobes present above the eyes. Mandibular blades with one or two preapical teeth or denticles. Propodeum only armed with spines **_STRUMIGENYS_** F. Smith (p. 345)

7 Antennal scrobes absent. Propodeum unarmed, smoothly rounded. First (basal) tarsal segment on each leg swollen, as broad as tibiae **_MELISSOTARSUS_** Emery (p. 347)

- – Antennal scrobes present above the eyes. Propodeum armed with a pair of spines or teeth. First tarsal segment on each leg slender 8
- 8 Apical border of mandible with more than 20 denticulae, the basal 4 to 8 of which may be considerably larger than those preceding. ***SERRASTRUMA*** Brown (p. 344)
- – Apical border of mandible with less than 10 teeth of variable size 9
- 9 Head elongate, always with numerous setae 10
- – Head not elongate, setae reduced to 2 or 3 on posterior dorsum ***TRICHOSCAPA*** Emery (p. 345)
- 10 Clypeal hairs bizarre, either flattened, clavate or spoon-shaped ***SMITHISTRUMA*** Brown (p. 345)
- – Clypeal hairs not bizarre, usually short and simple. ***CODIOMYRMEX*** Wheeler (p. 343)
- 11 Antennal scrobes present above the eyes; antennal club of three segments. Promesonotum produced into a shelf posteriorly, dentate or spinose behind and overhanging the propodeum, which is vertical or nearly so. Entire body densely clothed with fine hairs . . . . . ***MERANOPLUS*** F. Smith (p. 348)
- – Antennal scrobes absent; antennal club of two segments. Promesonotum not produced posteriorly, propodeum not vertical. Hairs sparse 12
- 12 Propodeum armed with a pair of spines or teeth or sharply angled. Worker caste dimorphic, without intermediate forms . . . ***OLIGOMYRMEX*** Mayr (p. 352)
- – Propodeum unarmed. Worker caste monomorphic 13
- 13 Eyes completely absent; mandibles armed with 5–6 teeth. Promesonotum not marginate laterally . . . . ***CAREBARA*** Westwood (p. 351)
- – Eyes present, small, of 2 ommatidia only; mandibles with 4 teeth. Promesonotum distinctly marginate laterally . . . . . ***PAEDALGUS*** Forel (p. 353)
- 14 Petiole without a node. Postpetiole attached to dorsum of first gastral segment, the gaster itself more or less heart-shaped in dorsal view and capable of reflexion over the alitrunk. . . . . . . ***CREMATOGASTER*** Lund (p. 342)
- – Petiole with a node. Postpetiole not attached to dorsum of first gastral segment; gaster not heart-shaped nor capable of reflexion over alitrunk 15
- 15 Antennal scrobes present above the eyes; antennal club 3-segmented. Clypeus not longitudinally bicarinate. Sting with a triangular lamella projecting apico-dorsally . . . . ***DECAMORIUM*** Forel (p. 355)
- – Antennal scrobes absent; antennal club 2-segmented. Clypeus longitudinally bicarinate. Sting without triangular lamelliform appendage 16
- 16 Propodeum smoothly rounded, neither sharply angulate nor dentate. Maxillary palpi geniculate. Mono- or polymorphic . ***SOLENOPSIS*** Westwood (p. 354)
- – Propodeum sharply angled or armed with a pair of spines or teeth. Maxillary palpi not geniculate. Dimorphic without intermediates. ***OLIGOMYRMEX*** Mayr (p. 352)
- 17 Postpetiole attached to dorsum of first gastral segment. Gaster more or less heart-shaped and capable of reflexion over the alitrunk. ***CREMATOGASTER*** Lund (p. 342)
- – Postpetiole not attached to dorsum of first gastral segment. Gaster not heart-shaped nor capable of reflexion over the alitrunk 18
- 18 Antennal scrobes present, either above or below the eyes 19
- – Antennal scrobes absent 23
- 19 Antennal scrobes below the eyes. Head, alitrunk and gaster dorsoventrally flattened, and often armed with spines or teeth along the sides of the head and alitrunk. First tergite forming the whole dorsal surface of the gaster when viewed from above . . . . ***CATAULACUS*** F. Smith (p. 342)
- – Antennal scrobes above eyes. Head, alitrunk and gaster not dorsoventrally flattened. More than one gastral tergite visible in dorsal view. 20
- 20 Antennal scrobes weak, bordered laterally by a longitudinal genal carina. Minute ants, 2 mm or less in total length . . . . ***WASMANNIA*** F. Smith (p. 350)

– Antennal scrobes more definitely marked, not bordered by lateral genal carinae. Larger, total length more than 2 mm 21

21 Median portion of clypeus vertical, with a distinct anteriorly projecting bilobed appendage dorsally; lateral portions of clypeus entire, not reduced to a narrow strip nor raised into a ridge in front of the antennal insertions. Head and body usually with some spatulate or otherwise bizarre hairs ***CALYPTOMYRMEX*** Emery (p. 347)

– Median portion of clypeus not vertical, without a bilobed appendage dorsally. Lateral portions of clypeus in front of antennal insertions reduced to a narrow strip or raised into a ridge. Head and body without spatulate or otherwise bizarre hairs 22

22 Sting with a spatulate lamella apically. Anterior margin of median portion of clypeus without projections. Pronotum always unarmed; petiole sometimes squamiform . . . . ***XIPHOMYRMEX*** Forel (p. 356)

– Sting acute, not ending in a spatulate lamella apically. Anterior margin of median portion of clypeus with a number of low, blunt, dentiform projections. Pronotum armed above with a pair of spines or a pair of low blunt tubercles; petiole never squamiform . . . . ***PRISTOMYRMEX*** Mayr (p. 348)

23 Antennal club of 2 segments. Propodeum armed with a pair of spines or teeth . 24

– Antennal club of 3 segments. Propodeum smoothly rounded, unarmed . . 25

24 Clypeus bicarinate. Dimorphic, without intermediates ***OLIGOMYRMEX*** Mayr (p. 352)

– Clypeus not bicarinate. Polymorphic, with a graded series of intermediates connecting minor to major workers . . ***PHEIDOLOGETON*** Mayr (p. 353)

25 Median portion of clypeus distinctly longitudinally bicarinate ***MONOMORIUM*** Mayr (p. 351)

– Median portion of clypeus somewhat swollen but not bicarinate ***DIPLOMORIUM*** Mayr (p. 351)

26 Petiole armed with a pair of spines or teeth above 27

– Petiole unarmed or merely emarginate above 28

27 Mesonotum bituberculate; propodeum armed with a pair of long spines ***ATOPOMYRMEX*** E. André (p. 348)

– Mesonotum not bituberculate; propodeum unarmed . ***TERATANER*** Emery (p. 349)

28 Spurs on middle and hind tibiae pectinate. . ***CRATOMYRMEX*** Emery (p. 349)

– Spurs on middle and hind tibiae simple or absent 29

29 Antennal club of 2 segments, the apical segment greatly enlarged. Clypeus produced into a lobe anteriorly. Basal internal margin of each mandible with a tooth . . . . ***ADELOMYRMEX*** Emery (p. 346)

– Antennal club of 3 or 4 segments, or absent. Basal internal margin of each mandible without a tooth 30

30 Lateral portions of clypeus with their posterior margins raised into a ridge in front of the antennal insertions. Sting with a lamelliform triangular appendage apicodorsally.

Propodeum usually bispinose and with a pair of metapleural lobes or teeth below the propodeal spines 31

– Lateral portions of clypeus not raised into a ridge in front of the antennal insertions. Sting without a lamelliform appendage apicodorsally 33

31 Head and body with trifid or multifid setae, usually abundant. (In most cases the trifid setae are best observed at mag. ×80 or above by viewing the alitrunk and pedicel in profile.) Antennal scrobes usually present, deep, divided into upper and lower compartments by a median longitudinal ridge which is incomplete posteriorly . . . . ***TRIGLYPHOTHRIX*** Forel (p. 356)

– Head and body usually with scattered simple setae, very rarely with multifid setae or without setae. Scrobes present or absent; when present, never as above . 32

32 Propodeum armed with a pair of spines or teeth of varying configuration. Metapleural lobes or teeth present. Palp formula usually 4,3.
TETRAMORIUM Mayr (p. 355)

– Propodeum unarmed, rounded. Metapleural lobes present. Palp formula 3,2.
RHOPTROMYRMEX Mayr (p. 355)

33 Antennal scrobes present above the eyes. Median portion of clypeus vertical, with a dorsal bilobed appendage projecting anteriorly. Usually with bizarre setae present on head, alitrunk and gaster . . ***CALYPTOMYRMEX*** Emery (p. 347)

– Antennal scrobes absent. Median portion of clypeus not vertical, without a bilobed appendage. Bizarre setae absent 34

34 Propodeum unarmed, smoothly rounded 35

– Propodeum armed with a pair of spines or teeth 36

35 Clypeus with median portion distinctly longitudinally bicarinate.
MONOMORIUM Mayr (p. 351)

– Clypeus with median portion rounded, not bicarinate.
SYLLOPHOPSIS Santschi (p. 355)

36 Gular surface of head with a psammophore. Polymorphic . ***MESSOR*** Forel (p. 350)

– Gular surface of head without a psammophore. Monomorphic, or dimorphic without intermediates 37

37 Anterodorsal angles of pronotum sharply angled in dorsal view. Body hairs either clavate or short and very stout. Petiole with a very short, broad peduncle anteriorly . . . . ***LEPTOTHORAX*** Mayr (p. 346)

– Anterodorsal angles of pronotum rounded in dorsal view. Body hairs either sparse or abundant and long, but always simple. Petiole with a long anterior peduncle 38

38 Dimorphic, without intermediates. In both castes petiolar node antero-posteriorly compressed, conical or subconical in profile and with the dorsal border usually emarginate. Major workers with head emarginate behind and with crushing mandibles usually equipped with 3 teeth, of which two are situated apically and one basally, separated by a large diastema. In the minor worker the sides of the head usually converge behind the eyes so that the occipital margin is short
PHEIDOLE Westwood (p. 350)

– Monomorphic. Petiolar node in profile domed or flattened above, never conical or subconical in shape, never emarginate above 39

39 Antennal scapes short, not surpassing occipital margin of head. Lateral portions of clypeus projecting forwards over the base of the mandibles. Pronotum smoothly rounded, not tuberculate. Alitrunk and gaster devoid of long setae
CARDIOCONDYLA Emery (p. 341)

– Antennal scapes very long, easily surpassing occipital margin of head. Lateral portions of clypeus not projecting forwards over base of mandibles. Pronotum with a small obtuse tubercle on each side. Entire body clothed with long erect setae . . . . ***MACROMISCHOIDES*** Wheeler (p. 347)

Subfamily DORYLINAE

1 Pedicel of 2 segments. Antennae 10-segmented; genae carinate. Pygidium not impressed, not armed with spines . . . . . ***AENICTUS*** Shuckard (p. 357)

– Pedicel of a single segment. Antennae 9- to 11-segmented: genae not carinate. Pygidium impressed, armed with a short spine or tooth at each side posteriorly.
DORYLUS Fabricius (p. 357)

Subfamily LEPTANILLINAE

– With a single genus in West Africa, answering the characters given in the key to subfamilies. . . . . ***LEPTANILLA*** Emery (p. 358)

Subfamily PSEUDOMYRMECINAE

1 Claws toothed. Palp formula 5,4. Funiculi of antennae not clubbed apically. Eyes occupying one third or more of the side of the head 2
– Claws simple. Palp formula 3,3. Funiculi with a club of three segments. Eyes smaller, occupying approximately one fifth of the side of the head **VITICICOLA** Wheeler (p. 359)
2 Both petiole and postpetiole with strong ventral processes. Eyes occupying about one third the side of the head. 3 ocelli present . **PACHYSIMA** Emery (p. 358)
– Petiole only with a weak ventral process, or both nodes without processes. Eyes occupying one third to one half the side of the head. Ocelli variable, often absent, but may be one, two or three developed **TETRAPONERA** F. Smith (p. 358)

Subfamily DOLICHODERINAE

1 Scale of petiole well developed, distinct, inclined anteriorly but not reduced nor overhung by first gastral segment dorsally . . **IRIDOMYRMEX** Mayr (p. 359)
– Scale of petiole reduced or vestigial; petiole overhung by first gastral segment dorsally, usually invisible in dorsal view 2
2 Palp formula 4,3, palpi short . . . . **ENGRAMMA** Forel (p. 359)
– Palp formula 6,4, palpi long 3
3 In dorsal view 5 gastral segments visible. Anal and associated orifices apical **TECHNOMYRMEX** Mayr (p. 360)
– In dorsal view 4 gastral segments visible. Anal and associated orifices ventral **TAPINOMA** Förster (p. 359)

Subfamily FORMICINAE

1 Antennae 9-segmented . . . . . . **APHOMOMYRMEX** Emery (p. 362)
– Antennae 11-segmented 2
– Antennae 12-segmented 4
2 Palp formula 1,3 or 2,3 Eyes minute. Small hypogaeic ants . . . . **ACROPYGA** Roger (p. 363)
– Palp formula 6,4. Eyes distinct; ocelli may be present 3
3 Propodeum bidentate or bituberculate; petiole usually bispinose or bidentate above, occasionally only with upper border strongly emarginate **ACANTHOLEPIS** Mayr (p. 363)
– Propodeum unarmed; petiole neither armed nor emarginate above. **PLAGIOLEPIS** Mayr (p. 364)
4 Eyes enormous, occupying almost all the side of the head. Ventrolateral margin of head with a tooth at each side. Propodeum bispinose **SANTSCHIELLA** Forel (p. 364)
– Eyes smaller, occupying less than one half the length of the side of the head. Ventrolateral margin of head unarmed; propodeum usually unarmed . . . 5
5 Ocelli present. Psammophore present on the anterior portion of the gular surface of the head. . . . . **CATAGLYPHIS** Förster (p. 361)
– Ocelli vestigial or absent; psammophore absent 6
6 Petiole reduced to an elongate, low node, allowing the gaster to be reflexed over the alitrunk. Mandibles elongate triangular, broad, the apical tooth long. Palp formula 5,4 . . . . **OECOPHYLLA** F. Smith (p. 363)
– Petiole a node or scale, never as above; mandibles not as above. Palp formula usually 6,4, rarely reduced to 3,4 or 3,3, but never 5,4 7
7 Antennal insertions very close to, or contiguous with the posterior clypeal margin. Acidopore borne on a conical projection of the hypopygium, forming a nozzle, the orifice surrounded by a fringe of hairs 8

– Antennal insertions some distance (usually greater than basal width of scape) behind the posterior clypeal margin. Acidopore not borne on a conical projection of the hypopygium, the orifice usually not surrounded by a fringe of hairs; or the acidopore hidden by a projection of the pygidium 10

8 Polymorphic. Eyes small in major workers, absent in minors. Clypeus overhanging mandibles in front. Palpi short, indistinct, palp formula reduced to 3,4 in major and 3,3 in minor workers . . ***PSEUDOLASIUS*** Emery (p. 362)

– Monomorphic. Eyes well developed, occasionally large. Clypeus not or only slightly overhanging the mandibles. Palp formula 6,4, the palpi long and distinct 9

9 Dorsum of alitrunk with very coarse setae arranged in distinct pairs. Eyes at or in front of the midlength of the head . ***PARATRECHINA*** Motschulsky (p. 361)

– Dorsum of alitrunk with fine setae, not definitely paired. Eyes behind the midlength of the head . . . . ***PRENOLEPIS*** Mayr (p. 362)

10 Anterodorsal pronotal angles usually projecting as spines or teeth, at least strongly marginate. Propodeum usually bispinose or bidentate; petiole with sharp angles, spines or teeth above. Monomorphic 11

– Anterodorsal pronotal angles rounded, unarmed. Propodeum unarmed although may be truncated posteriorly. Petiole a node or scale, never with teeth or spines. Polymorphic . . . . ***CAMPONOTUS*** Mayr (p. 360)

11 Clypeus flat, not longitudinally carinate in the middle, its anterior margin broadly and shallowly emarginate. Acidopore not concealed by the pygidium ***PHASMOMYRMEX*** Stitz (p. 360)

– Clypeus usually convex and longitudinally carinate, its anterior margin usually not emarginate. Acidopore concealed by the pygidium when not in use ***POLYRHACHIS*** F. Smith (p. 361)

SYNONYMIC SYNOPSIS AND NOTES ON THE GENERA

Subfamily **PONERINAE**

Tribe **AMBLYOPONINI**

AMBLYOPONE Erichson

Amblyopone Erichson, 1842, *Arch. Naturgesch.* **8**(1) : 260. Type-species: *Amblyopone australis* Erichson, 1842, op. cit. : 261, by monotypy.

Stigmatomma Roger, 1859, *Berl. ent. Z.* **3** : 250. Type-species: *Stigmatomma denticulatum* Roger, 1859, op. cit. : 251, by designation of Bingham, 1903.

Arotropus Provancher, 1881, *Can. Nat. & Geol.* **12** : 205. Type-species: *Arotropus binodosus* Provancher, 1881, by monotypy. (= *Amblyopone pallipes* (Haldeman) 1844, *Proc. Acad. nat. Sci. Philad.* **2** : 54.)

Xymmer Santschi, 1914, *Boll. Lab. Zool. gen. agr. Portici* **8** : 311 [as a subgenus of *Stigmatomma*]. Type-species: *Stigmatomma* (*Xymmer*) *muticum* Santschi, 1914, loc. cit., by monotypy.

Fulakora Mann, 1919, *Bull. Mus. comp. Zool. Harv.* **63** : 279 [as a subgenus of *Stigmatomma*]. Type-species: *Stigmatomma* (*Fulakora*) *celata* Mann, 1919, loc. cit., by original designation.

Neoamblyopone Clark, 1927, *in* Wheeler, *Proc. Am. Acad. Arts Sci.* **62** : 1 [as a subgenus of *Amblyopone*]. Type-species: *Amblyopone* (*Neoamblyopone*) *clarki* Wheeler, 1927, op. cit. : 24, by monotypy.

Protamblyopone Clark, 1927, *in* Wheeler, *Proc. Am. Acad. Arts Sci.* **62** : 1 [as a subgenus of *Amblyopone*]. Type-species: *Amblyopone* (*Protamblyopone*) *aberrans* Wheeler, 1927, op. cit. : 26, by monotypy.

Lithomyrmex Clark, 1928, *J. Proc. R. Soc. West. Aust.* **14** : 30–31. Type-species: *Lithomyrmex glauerti* Clark, 1928, loc. cit., by original designation.

Ericapelta Kusnezov, 1955, *Zool. Anz.* **154** : 273–274. Type-species: *Ericapelta egregia* Kusnezov, 1955, loc. cit., by monotypy.

The mandibles are long and narrow, inserted far apart at the corners of the clypeus and tending to cross over at rest; their apices acute and their inner margins dentate throughout the length of the blades. The median portion of the clypeus projects anteriorly as a lobe which usually bears a series of denticulae, but in *A. mutica* (Santschi) the lobe is straight and edentate in front. An anterolateral dentiform projection of the gena may be present. On the alitrunk the promesonotal suture is complete, the metanotal may be present or absent. Petiole massive, very broadly attached to the first gastral segment and without a free posterior face. Sculpture is usually fine; the head with fine dense puncturation which may be continued onto the pronotum, or with the pronotum more or less smooth and shining. Palp formulae of 5,3 ; 4,3 ; 3,2 and 2,2 have been recorded in the genus (Brown, 1960). Workers are found in moist soil and have been recovered from leaf-litter samples by Berlese funnel separation.

Amblyopone is represented in West Africa by a few rare and little known species, mostly with a savannah distribution.

MYSTRIUM Roger

Mystrium Roger, 1862, *Berl. ent. Z.* **6** : 245. Type-species: *Mystrium mysticum* Roger, 1862, loc. cit., by monotypy.

Mandibles very long, noticeably longer than the head, broad and blunt apically, their inner margins with a double row of short teeth. The anterior margin of the median portion of the clypeus is denticulate, the genal teeth are well developed and project anteriorly. Structure of alitrunk and petiole as in *Amblyopone* but the metanotal suture represented by a weak impression dorsally, which does not break the sculpture. The tarsal segments possess numerous spiniform setae, most abundant on the internal surface of the basal segment, more evenly distributed on the remaining segments. Sculpture of a coarse reticulation over the head and alitrunk; all dorsal surfaces of head and body with spatulate setae present. Menozzi (1929) and Brown (1960) give a palp formula of 4,3 for the genus.

Known only from a single species in West Africa, distributed throughout the forest zone, *M. silvestrii* Santschi has been noted in Ghana nesting in soil at the base of a cocoa tree in an old (abandoned) cocoa plantation.

Tribe **PLATYTHYREINI**

PLATYTHYREA Roger

Platythyrea Roger, 1863, *Berl. ent. Z.* **7** : 172. Type-species : *Pachycondyla punctata* F. Smith, 1858, *Cat. Hym. Brit. Mus.* **6** : 108, by designation of Bingham, 1903.

This genus and the one below constitute the tribe Platythyreini as represented in West Africa, and are easily recognizable by the distinctive sculpture which both possess.

Entirety of head, alitrunk, pedicel, gaster and appendages with very fine shagreening and with scattered larger, shallow punctures. All surfaces covered by an extremely fine dense pubescence and devoid of standing hairs.

Platythyrea is further distinguished by the possession of two pectinate spurs on each of the middle and hind tibiae, and the presence of a median tooth on the pretarsal claws. Palp formulae of 6,4 and 3,2 have been recorded in West African species, the majority of which nest in rotten wood on the ground or in rotten parts of standing trees. The lobes of the frontal carinae are usually broad and fused to the clypeus in front. Clypeus itself is broad and convex, not carinate; eyes are always present although they may be reduced. Antennae 12-segmented,

often with the second funicular segment longer than the first or third. Alitrunk with promesonotal suture distinct, the metanotal obsolete or absent. Petiole a large node, often with the posterodorsal margin extended into dentiform projections.

PROBOLOMYRMEX Mayr

Probolomyrmex Mayr, 1901, *Annln naturh. Mus. Wien* **16** : 2. Type-species: *Probolomyrmex filiformis* Mayr, 1901, op. cit. : 3, by monotypy.

Escherichia Forel, 1910, *Zool. Jb.*, Abt. Syst. **29** : 245. Type-species: *Escherichia brevirostris* Forel, 1910, op. cit. : 246, by monotypy.

Sculpture is as in *Platythyrea* above; *Probolomyrex* has the following distinguishing features. Frontal carinae fused together and fused to the clypeus, projecting as a plate over the mandibles. Antennae inserted close together and close to the anterior margin of this plate, their condylar bulbs exposed in dorsal view. Antennae 12-segmented, the funicular segments becoming thicker towards the apex. Palp formula 4,2 (Taylor, 1965). Alitrunk without dorsal sutures. Middle and hind tibiae each with a single pectinate spur; claws simple.

Probolomyrmex, a rare genus of small ants with a tropicopolitan distribution is represented in Africa by three species, one of which, *P. guineensis* Taylor occurs in West Africa. Nests are made in small pieces of rotted wood in cultivated or otherwise disturbed ground on the coastal plain.

Tribe **ECTATOMMINI**

DISCOTHYREA Roger

Discothyrea Roger, 1863, *Berl. ent. Z.* **7** : 176. Type-species: *Discothyrea testacea* Roger, 1863, op. cit. : 177, by monotypy.

Pseudosysphincta Arnold, 1916, *Ann. S. Afr. Mus.* **14** (2) : 161. Type-species: *Pseudosysphincta poweri* Arnold, 1916, op. cit. : 162, by original designation.

Prodiscothyrea Wheeler, 1916, *Trans. R. Soc. West. Aust.* **40** : 33. Type-species: *Prodiscothyrea velutina* Wheeler, 1916, op. cit. : 34, by monotypy.

Pseudosphincta Wheeler, 1922, *Bull. Am. Mus. nat. Hist.* **45** : 645, 762. [Variant spelling of *Pseudosysphincta*.]

Characters shared by the two genera *Discothyrea* and *Proceratium* include reduction in size of the eyes and depigmentation of the body in response to cryptobiotic habits, raised frontal carinae leaving the condylar bulbs of the antennae exposed in dorsal view, lack of sutures on the dorsum of the alitrunk, and strong vaulting of the second gastral segment so that the remaining segments are directed anteriorly below the first and second.

In *Discothyrea* the mandibles are overhung by the clypeus, and are edentate; the antennae are nine or eleven-segmented in known West African species, with the apical funicular segment strongly swollen and bulbous. Spurs on the middle tibiae small and simple, those on the hind tibiae pectinate. Sculpture of dense puncturation over most of the body.

Both species found in West Africa, *D. oculata* Emery with nine-segmented antennae, and *D. mixta* Brown with eleven-segmented antennae, are apparently confined to the forest zone. *D. oculata* is found throughout the region although quite rarely, whilst *D. mixta* was originally described from Liberia and is now also known to occur in Ghana.

Discothyrea and the closely related genus *Proceratium* represent the tribe Ectatommini in West Africa. The former genus has a southerly distribution, whilst the

latter is mostly confined to the northern hemisphere, but in the tropics their ranges tend to overlap. Both genera are cryptobiotic and form small colonies, usually in rotten wood just below the surface of the ground. Workers have also been recovered from Berlese funnel samples of leaf-litter.

PROCERATIUM Roger

Proceratium Roger, 1863, *Berl. ent. Z.* **7** : 171. Type-species: *Proceratium silaceum* Roger, 1863, op. cit. : 172, by monotypy.
Sysphingta Roger, 1863, *Berl. ent. Z.* **7** : 175. Type-species: *Sysphingta micrommata* Roger, 1863, op. cit. : 176, by monotypy.
Sysphincta Mayr, 1865, *Reise der . . . Fregatte Novara*, Zool. **2** : 12. Wien. [Emendation of *Sysphingta*.]

Known from West Africa by a single new species discovered at Legon, Ghana, in a small piece of rotten wood by D. Leston, and to be described elsewhere by him.

Proceratium shares a number of characters with *Discothyrea* as mentioned above but has the mandibles armed with three teeth, only slightly overhung by the clypeus, the antennae 12-segmented with the apical segment enlarged but not bulbous. Brown (1958) records palp formulae of 4,3; 3,2; and 2,2 in the genus; that of the West African species is found to be 4,3.

Tribe **ODONTOMACHINI**

ODONTOMACHUS Latreille

Odontomachus Latreille, 1805, *Hist. Nat. Crust. Ins.* **13** : 257. Type-species: *Formica haematoda* Linnaeus, 1758, *Syst. Nat.* ed. **10** : 582, by original designation.
Pedetes Bernstein, 1861, *Verh. zool.-bot. Ges. Wien* **11** : 7. Type-species: *Pedetes macrorhynchus* Bernstein, 1861. [Nomen nudum.]

Mandibles elongate, linear, inserted close to the midline of the anterior margin of the head and meeting throughout their length when at rest. When fully open the mandibles form a line at right angles to the long axis of the head. Apical mandibular armament of three teeth arranged in a vertical series, the dorsalmost tooth truncated. Eyes situated close to the anterior margin of the head, separated from the frontal carinae by a broad longitudinal impression. Palp formula 4,4 or 4,3. Node of petiole ending in a long spine dorsally; gaster not impressed between first and second segments.

Of the two species found in West Africa, *O. haematodus* (L.) prefers open or loosely wooded areas whilst *O. assiniensis* Emery is more commonly found in thick bush and more dense forest. Both species nest in rotten wood at ground level, and *O. haematodus* may nest at the bases of trees, especially in cultivated areas. When the nests are in such a location the ants often ascend the tree to forage, one of the few ponerine species to do so in West Africa.

ANOCHETUS Mayr

Anochetus Mayr, 1861, *Europ. Formicid.* : 53. Type-species: *Odontomachus ghilianii* Spinola, 1851, *Memorie Accad. Sci. Torino* (2)**13** : 71, by designation of Bingham, 1903.
Myrmapatetes Wheeler, 1929, *Am. Mus. Novit.* no. **349** : 6. Type-species: *Myrmapatetes filicornis* Wheeler, 1929, loc. cit., by original designation.

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Answering to the description given above for *Odontomachus* but the apical mandibular armament with the dorsalmost tooth acute, the palp formula 4,3 and the petiolar node not ending in a spine dorsally. Whilst these characters hold good for the species of West Africa they do not, unfortunately, apply throughout the world and *Anochetus* is at best a very weak genus, hardly if at all separable from *Odontomachus*.

The majority of species are found in leaf-litter and rotten wood, but one species is known to nest and forage arborially.

Tribe **PONERINI**

ASPHINCTOPONE Santschi

Asphinctopone Santschi, 1914, *Boll. Lab. Zool. gen. agr. Portici* **8** : 318. Type-species: *Asphinctopone silvestrii* Santschi, 1914, loc. cit., by monotypy.
Lepidopone Bernard, 1952, *Mém. Inst. franç. Afr. noire* no. **19** : 207. Type-species: *Lepidopone lamottei* Bernard, 1952, op. cit. : 208, by monotypy.

Mandibles somewhat elongate, armed with five teeth, the basal internal margin with a distinct notch just before the articulation, which is concealed by the clypeus when the mandibles are completely closed. Clypeus bluntly carinate, the median portion projecting as a rectangular lobe. Eyes reduced. Dorsum of alitrunk with promesonotal suture and metanotal groove present, distinct, the latter very deeply impressed, with longitudinal ribbing. Declivity of propodeum steep, marginate at sides and above. Petiole a high, narrow scale, the posterior peduncle with a number of distinct raised transverse ridges. Subpetiolar process complex, with three prominences. Gaster with a large anteroventral process on the first segment; not constricted between the first and second segments.

A. silvestrii Santschi has the head finely and densely punctate, the pronotum sparsely punctate with wide shining interspaces and a virtual lack of puncturation on the mesonotum. Propodeum with sparse, more coarse punctures, considerably larger than those on the pronotum.

This rarely found genus is closely related to *Mesoponera*. The specimens before me were found in a black-rotten, very wet banana trunk, near Ibadan, Western Nigeria.

BOTHROPONERA Mayr

Bothroponera Mayr, 1862, *Verh. zool.-bot. Ges. Wien.* **12** : 717. Type-species: *Ponera pumicosa* Roger, 1860, *Berl. ent. Z.* **4** : 29, by designation of Emery, 1901, *Annls Soc. ent. Belg.* **45** : 45.
Pseudoneoponera Donisthorpe, 1943, *Ann. Mag. nat. Hist.* (11)**10** : 439. Type-species: *Pseudoneoponera verecundae* Donisthorpe, 1943, loc. cit., by original designation.

Medium to large ants, usually quite coarsely sculptured and black in colour, occasionally dark brown or deep red-brown. Mandibles dentate, usually with six or seven teeth, reduced to four or five in the *B. nasica* Santschi group. *B. sjoestedti* (Mayr) has a mandibular fovea situated basally on the dorsolateral surface as in *Brachyponera*, *Trachymesopus* and *Cryptopone*. Palp formula usually 4,4, reduced to 2,2 in *B. sjoestedti* and the *B. nasica* group. Alitrunk with promesonotal suture present, mobile, the metanotal absent. In dorsal view the propodeum is scarcely or not narrower than the pronotum. Petiole thick and nodiform. Middle and hind tibiae each with a large pectinate and a small simple spur, the latter may be very much reduced in members of the *B. nasica* species-group.

The majority of *Bothroponera* species are bush and forest inhabiting ants, nesting in rotten wood or directly into hard-packed earth. The larger species are mostly

free foragers and often nocturnal, but the smaller forms are more cryptic and are often found in association with termites. Most free foraging species prefer well shaded and moist habitats and are very rarely found in the open.

BRACHYPONERA Emery

Brachyponera Emery, 1901, *Annls Soc. ent. Belg.* **45** : 43 [as a subgenus of *Euponera*.] Type-species: *Ponera senaarensis* Mayr, 1862, *Verh. zool.-bot. Ges. Wien.* **12** : 721, by original designation.

Brachyponera Emery; Wilson, 1958, *Bull. Mus. comp. Zool. Harv.* **119** : 346. [Raised to genus.]

Represented by a single species *B. senaarensis* (Mayr) in West Africa.

Mandibles with a distinct, oval pit or fovea on the dorsolateral surface. Palp formula 3,3. Eyes quite large, their maximum diameter distinctly greater than the maximum width of the scape. Promesonotal suture distinct, metanotal groove distinct and deeply impressed. Propodeum narrowed dorsally, in dorsal view narrower than the pronotum. Petiole a thick scale; gaster weakly impressed between first and second segments. Extremely finely and densely punctate everywhere.

B. senaarensis is essentially a savannah species, but penetrates the forest zone bordering on savannah. Nests are made directly into the soil, usually in direct sunlight which the species makes no attempt to avoid. It is present throughout the West African savannah.

CACOPONE Santschi

Cacopone Santschi, 1914, *Boll. Lab. Zool. gen. agr. Portici* **8** : 325. Type-species : *Cacopone hastifer* Santschi, 1914, loc. cit., by monotypy.

A monotypic genus very close to and probably inseparable from *Plectroctena*. It shares the characteristic mandibular form and articulation with *Plectroctena* (see below) and only differs from that genus in details of mandibular structure and nodal form.

Mandibles elongate, linear, the internal margins edentate but with the distal half distinctly swollen and then narrowing to the apex. Eyes very much reduced and depigmented, difficult to see. Petiole node without a distinct anterior face, in profile this surface rounding convexly into the dorsal surface.

C. hastifer Santschi is a little known species whose life-way is apparently completely subterranean; confined to forested areas.

CENTROMYRMEX Mayr

Centromyrmex Mayr, 1866, *Verh. zool.-bot. Ges. Wien* **16** : 894. Type-species: *Centromyrmex bohemanni* Mayr, 1866, op. cit. : 895, by monotypy.

Spalacomyrmex Emery, 1889, *Annali Mus. civ. Stor. nat. Giacoma Doria* **27** : 489. Type-species: *Spalacomyrmex feae* Emery, 1889, loc. cit., by monotypy.

Typholoteras Karawajew, 1925, *Konowia* **4** : 128. Type-species: *Typhloteras hamulatum* Karawajew, 1925, op. cit. : 129, by monotypy.

Glyphopone Forel, 1913, *Revue Zool. afr.* **2** : 308. Type-species: *Glyphopone bequaerti* Forel, 1913, loc. cit., by monotypy.

Leptopone Arnold, 1916, *Ann. S. Afr. Mus.* **14** : 163 [as a subgenus of *Glyphopone*]. Type-species: *Glyphopone (Leptopone) rufigaster* Arnold, 1916, loc. cit. [= *Centromyrmex bequaerti* (Forel, 1913)], by original designation.

A single West African species, *C. sellaris* Mayr.

Mandibles strongly downcurved; median portion of clypeus almost vertical; eyes absent. Pronotum and mesonotum flat dorsally, the former strongly margined anteriorly and laterally Metanotal groove absent but propodeum pinched in, and strongly concave at about the middle of its length in lateral view. Propodeum convex behind this impression and rounding into an almost straight and vertical declivitous face. Subpetiolar process a simple spine; gaster not constricted between first and second segments. Coxae large, those of the anterior legs relatively enormous. Tarsal segments on all legs equipped with numerous downcurved spines and stiff setae, present also on the extensor (outer) surfaces of the middle tibiae and the apices of the hind tibiae. Apical spurs of tibiae of middle legs both small and simple; hind tibiae with one large pectinate and one small simple spur.

C. sellaris is a totally subterranean ant usually found with termites either in or under rotten logs which the termites are eating, or moving through galleries in the outer walls of the nests of mound-building termites Occasionally it is found in hard-packed earth above colonies of termites which do not raise mounds. The abundantly spiny tarsi of this species give traction on the walls of underground tunnels and are found (less well developed) in other, unrelated genera which have similar habits.

CRYPTOPONE Emery

Cryptopone Emery, 1892, *Annls Soc. ent. Fr.* **61** : 275. Type-species: *Cryptopone testacea* Emery, 1893, *Annls Soc. ent. Fr.* **62** : 240–241, nec ?*Amblyopone testacea* Motschulsky. 1863, *Bull. Soc. Nat. Moscou* **36** : 15, by designation of Wilson, 1958, *Bull. Mus. comp. Zool. Harv.* **119** (4) : 360–361.

Small ants (less than 4 mm), yellowish or ferruginous in colour. Apical mandibular margin armed with four to six teeth; basally the mandible with a distinct pit or fovea on the dorso-lateral surface. Middle tibiae with stout spinules on the extensor surface. Eyes minute or absent. Palp formula 2,2 or less (Brown, 1963).

The two species originally described from Africa in this genus were removed to *Ponera* by Brown (1963 : 6) and later to *Hypoponera* by Taylor (1967 : 11), who also pointed out that a number of small African species of *Hypoponera* are convergent upon *Cryptopone*. Brown (1963 : 4) indicates that ponerine ants possessing a basal mandibular pit or fovea are chiefly of African origin and expresses surprise that 'no true *Cryptopone* are known to occur in Ethiopian Africa'. The genus is included in the present study on the assumption that specimens will eventually be discovered in sub-Saharan Africa.

HYPOPONERA Santschi

Hypoponera Santschi, 1938, *Bull. Soc. ent. Fr.* **43** : 78–80 [as a subgenus of *Ponera*]. Type-species: *Ponera abeillei* E. André, 1881, *Annls Soc. ent. Fr.* (6)**1** : 48, by original designation.

Hypoponera Santschi; Taylor, 1967, *Pacif. Insects Monogr.* **13** : 9–12. [Raised to genus.]

Small ants superficially similar to *Cryptopone* above. Mandibles armed with three or four teeth apically, usually followed by a series of denticulae, without a basal mandibular pit. Palp formula 1,1, or 1,2 (Taylor, 1967). Eyes reduced, usually present but absent in a few species. Middle and hind tibiae each with a single pectinate spur; no spinules present on extensor surfaces of middle tibiae. Sculpture usually of fine dense puncturation.

Species of *Hypoponera* are common in West Africa, in leaf-litter and log-mould and are found nesting in fallen twigs, rotten logs (particularly when the bark is still present), compressed leaf-litter or hard-packed earth. Colonies are small and the individual ants are relatively slow-moving. Some species look very similar to *Cryptopone*, as mentioned above, but the distinctions given are sufficient to separate the two genera. True *Ponera*, as defined by Taylor (1967: 5–9) does not occur in West Africa.

LEPTOGENYS Roger

Leptogenys Roger, 1861, *Berl. ent. Z.* **5** : 41. Type-species: *Leptogenys falcigera* Roger, 1861, op. cit. : 42, by designation of Bingham, 1903.
Dorylozelus Forel, 1915, *Ark. Zool.* **9**(19) : 24–25. Type-species: *Dorylozelusm joebergi* Forel, 1915, loc. cit., by monotypy.
Microbolbos Donisthorpe, 1948, *Entomologist* **81** : 170. Type-species: *Microbolbos testaceus* Donisthorpe, 1948, loc. cit., by original designation.

Formerly included in its own tribe, Leptogenyini, which was synonymized to Ponerini by Brown (1963).

Mandibles of varying shape, may be elongate, linear and curved, or short and quite broad but always more or less edentate, with only one or two teeth situated apically. Mandibles articulated at extreme corners of anterior margin of head. Median portion of clypeus carinate, produced anteriorly into a lobe or point. Palp formula 4,4. Lobes of frontal carinae small, usually only partially covering the condylar bulbs of the antennal scapes in dorsal view. Middle and hind tibiae each with one large pectinate and one small simple spur. Claws pectinate, incompletely so in some species. Gaster weakly impressed between first and second segments.

The genus *Leptogenys* is distributed throughout West Africa but the greatest number of species inhabit the forest zone where they usually nest in wet-rotten wood or in hard-packed soil, and in leaf-litter under fallen tree trunks.

MEGAPONERA Mayr

Megaponera Mayr, 1862, *Verh. zool.-bot. Ges. Wien* **12** : 734. Type-species: *Formica foetens* Fabricius, 1793, *Ent. Syst.* **2** : 354, by monotypy.
Megaloponera Roger, 1863, *Verzeichniss Formiciden-Gattungen:* 17. Type-species: *Formica foetens* Fabricius, 1793, *Ent. Syst.* **2** : 354, by monotypy.

A monotypic genus, the species of which is confined to savannah regions in West Africa.

Dimorphic. Palp formula 4,4. Clypeus with median area swollen but not carinate nor raised and projecting. Gena on each side with a distinct longitudinal carina running from the eye to the mandibular insertion. Middle and hind tibiae each with one large pectinate and one small simple spur; claws armed with a tooth near the base.

M. foetens (F.) has an aromatic odour and stridulates audibly when disturbed. Nests are made in the earth, from which columns of ants emerge to raid nearby termite nests.

MESOPONERA Emery

Mesoponera Emery, 1901, *Annls Soc. ent. Belg.* **45** : 43 [as a subgenus of *Euponera*]. Type-species: *Ponera caffraria* F. Smith, 1858, *Cat. Hym. Brit. Mus.* **6** : 91, by original designation.
Mesoponera Emery; Wilson, 1958, *Bull. Mus. comp. Zool. Harv.* **119** : 349. [Raised to genus.]

Mandibles triangular or elongate triangular, usually with more than eight teeth, without a basal pit on the dorsolateral surface. Palp formula 4,4. Clypeus longitudinally carinate, may project anteromedially as a short tooth. Promesonotal suture present, metanotal groove present and impressed. Propodeum compressed above, its dorsum considerably narrower than the pronotum. Petiole a thick scale. Middle and hind tibiae each with two spurs, one large and pectinate, the other small and simple. Extensor surfaces of middle tibiae without spinules; claws simple. Sculpture of fine dense puncturation.

The West African species of *Mesoponera* nest in rotten wood on the ground and forage in the leaf-litter and in the soil below logs and stones.

PALTOTHYREUS Mayr

Paltothyreus Mayr, 1862, *Verh. zool.-bot. Ges. Wien.* **12** : 735. Type-species: *Formica tarsata* Fabricius, 1798, *Ent. Syst. Suppl.* : 280, by monotypy.

The single species of this genus, *P. tarsatus* (F.), is the common 'Stink Ant'.

Large, total length 15 mm or more. Clypeus with median portion abruptly raised and projecting forwards as a truncated lobe. Palp formula 4,4. Promesonotal suture distinct, metanotal groove indicated by a weak impression which does not break the sculpture. Petiole a thick scale. Middle and hind tibiae each with a large pectinate and a small simple spur. claws with a median tooth. Head and alitrunk striate dorsally, strongly arched on the pronotum; Generally the sculpturation becomes finer from the front to the back of the dorsum of the alitrunk, disappearing on the gaster.

Nests are made directly into the ground, either in the open or with the nest entrance beside a rock or piece of wood. The ants are general scavengers and carnivores, usually foraging singly but occasionally found in small processions.

PHRYNOPONERA Wheeler

Phrynoponera Wheeler, 1920, *Psyche, Camb.* **27** : 53. Type-species: *Bothroponera gabonensis* E. André, 1892, *Revue Ent.* **11** : 50, by original designation.

Mandibles with four to seven teeth; palp formula 4,4. Median portion of clypeus bluntly bidentate in the more common species, but not so in all species. Promesonotal suture present, metanotal absent. Propodeum with two blunt, dorsoventrally flattened spines or teeth. Petiole a thick scale, recurved over the anterior dorsum of the first gastral segment and terminating dorsally in a comb of five teeth. Gaster not impressed between first and second segments.

Nests in damp-rotten logs, usually well embedded in leaf-litter or soil, and often associated with termites. Uncommon ants, very rarely found outside the log containing the nest. The genus is very closely related to *Bothroponera*.

PLECTROCTENA F. Smith

Plectroctena F. Smith, 1858, *Cat. Hym. Brit. Mus.* **6** : 101. Type-species: *Plectroctena mandibularis* F. Smith, 1858, loc. cit., by monotypy.

Mandibles elongate, linear, weakly curved, with not more than two blunt teeth on the inner margin. Mandibular articulation associated with a marked excavation of the anterior margin of the head in front of the eye. Palp formula 2,4. Median portion of clypeus reduced, vertical; the frontal carinae almost overhanging the anterior margin of the head in dorsal view. Eyes small to minute, occasionally depigmented. Promesonotal suture distinct; metanotal groove absent or represented by a weak impression on the dorsum of the alitrunk. Petiole a distinct node; gaster strongly impressed between first and second segments. Middle and hind tibiae each with a single pectinate spur; claws simple.

Nests are made in rotten wood, usually of fallen trees with the bark still attached, by the larger black species of the *P. mandibularis* F. Smith group of species. The smaller, depigmented (usually red-brown) species of the *P. subterranea* Arnold group prefer wood in a much more advanced state of decay, or nest directly into hard-packed earth. Sculpturation throughout the genus is mostly of puncturation, which tends to be more coarse in the *P. subterranea* group, and in which the eyes are much more reduced than in the larger species.

PROMYOPIAS Santschi

Promyopias Santschi, 1914, *Boll. Lab. Zool. gen. agr. Portici* **8** : 323 [as a subgenus of *Myopias*]. Type-species: *Myopias (Promyopias) silvestrii* Santschi, 1914, op. cit.: 324, by monotypy.
Promyopias Santschi; Emery, 1915, *Boll. Lab. Zool. gen. agr. Portici* **10** : 26. [Raised to genus.]

Mandibles elongate, weakly curved, armed apically with three teeth, the inner margins retaining traces of small teeth. Median portion of clypeus not wholly vertical, the frontal carinae not overhanging the anterior margin of the head. Mandibular articulations not associated with marked excavations of the anterior margin of the head. Extensor surfaces of middle tibiae with numerous spines and stiff setae. Hind tibiae with two spurs, one large and pectinate, the other small and simple; claws simple. Petiole a node, gaster very weakly impressed between first and second segments.

The single species *P. silvestrii* Santschi is rare and apparently restricted to the forest zone.

PSALIDOMYRMEX E. André

Psalidomyrmex E. André, 1890, *Revue Ent.* **9** : 313. Type-species: *Psalidomyrmex foveolatus* E. André, 1890, op. cit. : 314, by monotypy.

Rare, medium to large ants restricted to the forest zones of West and Central Africa.

Mandibles edentate to weakly toothed, varying in shape from subtriangular to falcate, always with the apex prolonged into a long, acute point, crossing over at rest. Basal mandibular groove distinct. Palp formula 3,4. Promesonotal suture distinct, mobile, metanotal absent. Petiole a node; gaster strongly impressed between first and second segments. Middle and hind tibiae with a single pectinate spur, claws simple. Basic sculpture consists of large shallow foveolae or pits, from each of which a single seta arises. The interspaces between such pits usually finely striate.

The species of this uncommon genus nest in rotten wood, usually in an advanced state of decay, and forage in and below rotten logs and in deep leaf-litter.

TRACHYMESOPUS Emery

Trachymesopus Emery, 1911, *Genera Insect.*, Ponerinae : 84 [as a subgenus of *Euponera*]. Type-species: *Formica stigma* Fabricius, 1804, *Syst. Piez.* : 400, by original designation.
Trachymesopus Emery; Wilson, 1958, *Bull. Mus. comp. Zool. Harv.* **119** : 352. [Raised to genus.]

Mandibles triangular, dentate; basally with a distinct pit or fovea on the dorsolateral surface. Palp formula 4,4. Clypeus carinate medially. Eyes small, their maximum diameter less than the maximum width of the scape. Promesonotal suture distinct, metanotal groove present, very weakly impressed. Propodeum compressed, its dorsum narrower than that of the pronotum. Petiole a thick scale; gaster distinctly impressed between the first and second segments. Middle and hind tibiae each with one large pectinate and one small simple spur, claws simple. Sculpture of fine dense puncturation.

The single species occurring in West Africa, *T. brunoi* (Forel), is quite common in wooded areas, nesting either in rotten wood or in soil and foraging in leaf-litter, rotten wood, or in the earth, often being found with termites.

Subfamily **CERAPACHYINAE**
Tribe **CERAPACHYINI**
CERAPACHYS F. Smith

Cerapachys F. Smith, 1857, *J. Proc. Linn. Soc.* **2** : 74. Type-species: *Cerapachys antennatus* F. Smith, 1857, loc. cit., by monotypy.

Antennae 11- or 12- segmented, the apical funicular segment greatly swollen and forming a one-segmented club. Mandibles edentate or denticulate; palp formula 2,2 (Gotwald, 1969.) Frontal carinae raised, exposing the condylar bulbs of the antennae in dorsal view. Genae longitudinally carinate; eyes present. Dorsum of alitrunk devoid of sutures. Petiole a distinct and massive node; gastral constriction between the first and second segments often extreme, so that the pedicel in some species consists, to all intents and purposes of petiole and postpetiole. Petiole never marginate laterally. Pygidium impressed, armed laterally or posteriorly with a row of spines or denticulae. Middle and hind tibiae with two spurs, claws simple.

Usually small, black or brown-black ants nesting in soil, rotten twigs or small pieces of wood in the leaf-litter. Specimens are most often obtained by use of a Berlese funnel. Nests may occasionally be found under the bark of trees, at or near ground level. Uncommon ants, all known species raid the nests of other ants for food.

PHYRACACES Emery

Phyracaces Emery, 1902, *Rc. Sess. Accad. Sci. Ist. Bologna*, N.S. **6** : 23. Type-species: *Cerapachys mayri* Forel, 1892, *in* Grandidier, *Hist. Nat. Phys. Madagascar* **20** : 244, by original designation.

Closely related to, and answering to the description of *Cerapachys* above; differing in the following respects:

Antennae 12-segmented, the apical three funicular segments forming a club. Palp formula 4,3 in species examined. Node of petiole distinctly marginate laterally and often armed posterodorsally with a pair of teeth.

Nesting and foraging as in *Cerapachys*.

SPHINCTOMYRMEX Mayr

Sphinctomyrmex Mayr, 1866, *Verh. zool.-bot. Ges. Wien* **16** : 895. Type-species: *Sphinctomyrmex stahli* Mayr, 1866, loc. cit., by monotypy.
Aethiopopone Santschi, 1930, *Bull. Annls Soc. ent. Belg.* **70** : 49. Type-species: *Sphinctomyrmex rufiventris* Santschi, 1915, *Annls Soc. ent. Fr.* **84** : 244, by original designation.

Answering to the description of *Cerapachys* above but differing in the following respects: Antennae of twelve segments, club of funiculus not formed of apical segment only. Palp formula 3,3 (Gotwald, 1969). Eyes absent. Segments of gaster separated from each other by distinct constrictions.

Rare, collected only from Berlese funnel extracts of forest leaf-litter.

Tribe CYLINDROMYRMICINI

SIMOPONE Forel

Simopone Forel, 1891, *in* Grandidier, *Hist. Phys. Nat. Madagascar* **20,** 2 : 139. Type-species: *Simopone grandidieri* Forel, 1891, op. cit.: 141, by monotypy.

Mandibles edentate or weakly denticulate. Palp formula 6,4 or 3,2 in species examined. Frontal carinae reduced, but not usually vertical, the condylar bulbs of the antennae visible. Antennae 11-segmented, the scape short, flattened and subtriangular in shape. Eyes large, ocelli present. Dorsum of alitrunk devoid of sutures although the line of the promesonotal suture may be marked by a row of pits or short longitudinal ribs. Petiole a low node; constriction between first and second gastral segments deep. Pygidium impressed, armed on each side by a row of stumpy spines. Middle tibiae without spurs, hind tibiae each with a large pectinate spur; claws toothed.

Arboreal ants, usually black in colour, more rarely depigmented and yellowish. Nests are made in hollow twigs or rotten branches of trees, often a considerable distance above ground. The species are rare and appear to be mainly nocturnal in behaviour.

Subfamily MYRMICINAE

Tribe CARDIOCONDYLINI

CARDIOCONDYLA Emery

Cardiocondyla Emery, 1869, *Annali Accad. Aspir. Nat. Napoli* (2) **2** : 20. Type-species: *Cardiocondyla elegans* Emery, 1869, op. cit. : 21, by monotypy.
Emeryia Forel, 1890, *Annls Soc. ent. Belg.* **34** : 110. Type-species: *Emeryia wroughtoni* Forel, 1890, loc. cit., by monotypy.

Lateral portions of clypeus projecting forwards over the basal margins of the mandibles. Eyes well developed, situated well in front of the midlength of the head. Antennae 12-segmented, with a three-segmented club, the scapes short, failing to reach the posterior margin of the head. Promesonotal suture absent, metanotal groove impressed. Propodeum armed with

a pair of teeth or spines. Petiole with a long peduncle in front; in dorsal view the postpetiole very broad, almost or quite twice as broad as the petiole. Middle and hind tibiae without spurs. Sculpture usually of fine dense puncturation on head and alitrunk, absent from the gaster. A sparse pubescence present but no long setae except on the anterior clypeal margin.

Small to minute ants which nest in soil, usually at the bases of trees, or in compressed leaf-litter. The workers forage in the leaf-litter or ascend trees to tend aphids and coccids.

Tribe **CATAULACINI**

CATAULACUS F. Smith

Cataulacus F. Smith, 1853, *Trans ent. Soc. Lond.* **2** : 225. Type-species: *Cataulacus taprobanae* F. Smith, 1853, loc. cit., by designation of Bingham, 1903.

Mandibles edentate to weakly denticulate. Palp formula 5,3. Antennae 11-segmented with a club of three segments. Antennal scrobes present, running below the eyes which are usually well developed and situated behind the midlength of the head. Sides of head between eye and occipital corner often armed with numerous laterally projecting denticles, the occipital corner itself usually armed with a tooth. Dorsum of alitrunk without sutures or with the sutures weakly marked. Sides of pronotum strongly marginate, armed with a number of small teeth or an angular projection. Propodeum with a pair of spines or teeth. Entire visible dorsum of gaster occupied by the tergite of the first segment. Head, alitrunk and gaster considerably dorsoventrally compressed.

Armoured, usually black, arboreal ants nesting in hollow or rotten twigs and branches which are still attached to the tree.

Tribe **CREMATOGASTRINI**

CREMATOGASTER Lund

Crematogaster Lund, 1831, *Annls Sci. nat.* **23** : 132. Type-species: *Formica scutellaris* Olivier, 1791, *Encyl. Méthod. Histoire Naturelle.* Insectes **6** : 497, by designation of Bingham, 1903.
Acrocoelia Mayr, 1852, *Verh. zool.-bot. Ges. Wien.* **2** : 146. Type-species: *Acrocoelia ruficeps* Mayr, 1852, op. cit. : 147 [= *Formica scutellaris* Olivier, 1791].
Tranopeltoides Wheeler, 1922, *Am. Mus. Novit.* no. **48** : 10. Type-species: *Tranopelta huberi* Forel, 1907, *Hamburg. Jb. wiss. Anst.* **24** (2) : 5, by original designation.

Mandibles with four or five teeth; palp formula usually 5,3, rarely 4,3. Antennae 10- or 11-segmented, the club undifferentiated or of two, three or four segments. Eyes present, usually well developed, situated at or just behind the midlength of the side of the head. Promesonotal suture usually represented by a weak impression which fails to break the sculpture, more rarely it is well developed or absent. Metanotal groove impressed, often deeply so. Propodeum armed with a pair of spines or teeth, rarely reduced to tubercles or absent. Petiole dorsoventrally flattened, without a node, the dorsal surface weakly convex to weakly concave. Postpetiole a node, often with a median longitudinal groove, attached to the dorsum of the first gastral segment. Gaster heart-shaped or triangular in dorsal view. Sting spatulate. Tarsal claws simple, often large.

A large genus of mostly arboreal ants. In the majority of cases nests are made in hollow or rotten twigs and branches, or directly into the trunk of the tree, but in some cases a large carton-nest of chewed wood is made and attached to the trunk, often high up the tree.

The unusual construction of the pedicel allows the gaster to be reflexed over the alitrunk, and when agitated the ants run about with the gaster held in this position. Most species are avid tenders of coccids and some build protective tents of vegetable matter over aggregations of coccids.

Tribe **DACETINI**

CODIOMYRMEX Wheeler

Codiomyrmex Wheeler, 1916, *Bull. Mus. comp. Zool. Harv.* **60** : 326. Type-species: *Codiomyrmex thaxteri* Wheeler, 1916, op. cit., : 327, by original designation.

Mandibles short, subtriangular, with less than ten teeth arranged in such a way that in dorsal view only three or four are visible, the rest arranged in a more or less vertical series on the down-curved apical portion of the mandible. Antennae six-segmented, the second and third funicular segments reduced. Antennal scrobes present above the eyes. Dorsum of alitrunk without sutures; propodeum armed with a pair of small teeth subtended by a lamella running the height of the declivity. Petiole and postpetiole with well developed spongiform appendages.

Clypeus smooth and shining with abundant simple setae, rest of head reticulate-punctate. Dorsum of alitrunk, postpetiole and first gastral segment mostly smooth and shiny, the last with distinct longitudinal striations.

Minute (2 mm or less) brown-black ants found as yet only in Berlese funnel samples of forest leaf-litter in West Africa.

EPITRITUS Emery

Epitritus Emery, 1869, *Boll. Soc. ent. Ital.* **1** : 136. Type-species: *Epitritus argiolus* Emery, 1869, loc. cit., by monotypy.

Mandibles elongate with 0–1 preapical teeth. Apical armament consisting of a long dorsal spiniform tooth subtended by a vertical series of denticulae or by the denticulae alone. Labrum projecting anteriorly between the mandibles as a biconical structure. Antennae 4- or 6-segmented, the scape lobiform basally. Antennal scrobes present above the reduced eyes. Promesonotal suture represented by a weak impression or absent, similarly with the metanotal groove, which is however usually more distinct than the promesonotal suture. Spongiform appendages of pedicel greatly reduced or absent. Head with numerous large orbicular hairs. Sculpture finely reticulate-punctate.

Minute ants, 1·2–2·2 mm total length.

Three West African species are known, one from the savannah region of Northern Nigeria, the other two from Eastern Ghana, in the forest zone. The savannah species nests in rotten wood which is probably true of the forest forms, known at present only from Berlese funnel samples of leaf-litter.

MICCOSTRUMA Brown

Miccostruma Brown, 1948, *Trans Am. ent. Soc.* **74** : 123. Type-species: *Epitritus mandibularis* Szabo, 1909, *Archvm zool., Bpest* **1** (7) : 1–2, by original designation.

Mandibles subtriangular, serially dentate, concealed for most of their length by the very well developed, anteriorly projecting clypeus, which is fringed anteriorly and laterally by flattened hairs. Antennae 4-segmented; antennal scrobes present. Sutures absent from dorsal alitrunk. Propodeum bidentate, with ventral laminae running down the declivity.

Spongiform appendages of pedicel well developed. Dorsum of head with fine, scattered punctures, hairs absent except on clypeus. Dorsum of alitrunk, pedicel and gaster mostly shiny with small, widely spaced punctures. Base of first gastric tergite with longitudinal striae.

Minute ants, about 2 mm total length. Foraging workers occur in leaf-litter.

MICRODACETON Santschi

Microdaceton Santschi, 1913, *Bull. Soc. ent. Fr.* : 478. Type-species: *Microdaceton exornatum* Santschi, 1913, loc. cit., by monotypy.

Mandibles elongate, linear, without preapical armament; apical armament of three spiniform teeth. Antennae 6-segmented; antennal scrobes absent. Gena in front of eye with a laterally projecting tooth; occipital lobes of head armed with teeth. Promesonotum posteriorly, propodeum and petiole bispinose or bidentate; postpetiole with lateral alar appendages.

Uncommon. Recovered from leaf-litter by Berlese funnel extraction and also from soil-pockets on trees.

QUADRISTRUMA Brown

Quadristruma Brown, 1949, *Trans. Am. ent. Soc.* **75** : 47. Type-species: *Epitritus emmae* Emery, 1890, *Boll. Soc. ent. Ital.* **22** : 70, by original designation.

Mandibles elongate, linear, strongly curved; preapical armament a single long, spiniform tooth, apical armament a fork of two teeth. Labrum not projecting between mandibles as a biconical structure. Antennae 4-segmented; antennal scrobes present. Head with orbicular hairs present. Sculpture a fine puncto-reticulation, first gastral segment shiny except for basigastric costulae.

Q. emmae (Emery), a pantropical tramp species, is here recorded for the first time from West Africa. A single alate female was taken on a sticky trap hung from a cocoa tree (*Theobroma cacao* L.) at Bunso, Eastern Region of Ghana, in early October, 1969. Previously Brown (1954) had indicated that *Quadristruma* was most likely of African origin and its presence on the continent is now confirmed.

SERRASTRUMA Brown

Serrastruma Brown, 1948, *Trans. Am. ent. Soc.* **74** : 107 [as a subgenus of *Smithistruma*]. Type-species: *Strumigenys simoni* Emery, 1895, *Annls Soc. ent. Fr.* **63** : 42, by original designation.
Serrastruma Brown; Brown, 1949, *Mushi* **20** : 6. [Raised to genus.]

Mandibles elongate triangular, serially denticulate, with more than twenty denticulae, the basal 4–8 of which may be much larger than those preceding. Antennae 6-segmented, the second and third segments of the funiculus reduced; antennal scrobes present. Promesonotal suture represented by a weak impression or absent. Sometimes pronotum separated from mesonotum by a change in sculpture. Metanotal groove impressed; propodeum armed with a pair of teeth, may be reduced. Spongiform appendages of pedicel usually reduced.

Small yellow-brown ants nesting in rotten wood and foraging there and in leaf-litter. One species, *S. maynei* (Forel), is subarboreal, nesting in small rot-holes in the trunks and branches of low trees. This genus and *Strumigenys* constitute the most common members of the tribe Dacetini in West Africa.

SMITHISTRUMA Brown

Smithistruma Brown, 1948, *Trans Am. ent. Soc.* **74** : 104. Type-species: *Strumigenys pulchella* Emery, 1895, *Zool. Jb. Syst.* **8** : 327, by original designation.
Cephaloxys F. Smith, 1864, *J. Proc. Linn. Soc.* **8** : 76, nom. preocc.

Mandibles triangular, armed with 10 or less small teeth or denticulae. Antennae 6-segmented, the second and third funciular segments reduced, may be very small; antennal scrobes present. Head often very much elongated. Promesonotal suture absent or marked by a weak impression; metanotal groove weakly or not impressed. Spongiform appendages of pedicel usually well developed.

Uncommon, nesting in rotten twigs or in compressed leaf-litter, occasionally directly into soil at the bases of trees. Most workers are retrieved from Berlese funnel samples of leaf-litter.

STRUMIGENYS F. Smith

Strumigenys F. Smith, 1860, *J. ent. London* **1** : 72. Type-species: *Strumigenys mandibularis* F. Smith, 1860, loc. cit., by monotypy.
Labidogenys Roger, 1862, *Berl. ent. Z.* **6** : 249. Type-species: *Labidogenys lyroessa* Roger, 1862, op. cit. : 251, by monotypy.
Pyramica Roger, 1862, *Berl. ent. Z.* **6** : 251. Type-species: *Pyramica gundlachi* Roger, 1862, op. cit. : 253, by monotypy.
Proscopomyrmex Patrizi, 1946, *Boll. Ist. ent. Univ. Bologna* **15** : 294. Type-species: *Proscopomyrmex londianensis* Patrizi, 1946, op. cit., : 295, by original designation.
Eneria Donisthorpe, 1948, *Ann. Mag. nat. Hist.* (11) **14** : 598. Type-species: *Eneria excisa* Donisthorpe, 1948, loc. cit., by original designation.

Mandibles elongate, linear; preapical armament usually of two teeth on the distal portion of the blade, occasionally with one tooth missing from one of the blades. Apical armament of a fork of two spiniform teeth, with or without intercalary denticles. Antennae 6-segmented, the second and third funicular segments reduced, sometimes so reduced that the antennae appears four-segmented. Antennal scrobes present. Often the ventrolateral margin of the head is excised in front of the eye forming the characteristic preocular notch of *S. rogeri* Emery and allies.

Nests in rotten wood, leaf-litter, or directly into hard-packed earth. Two species are arboreal and nest in rot-holes in the trunks and branches of low trees. The smaller species often nest in small twigs in the leaf-litter or in compressed leaf-mould and are quite common in Berlese funnel samples from the forest zone.

TRICHOSCAPA Emery

Trichoscapa Emery, 1869, *Annali Accad. Aspir. Nat. Napoli* (2) **2** : 24 [as a subgenus of *Strumigenys*]. Type-species: *Strumigenys* (*Trichoscapa*) *membranifera* Emery, 1869, loc. cit., by monotypy.
Trichoscapa Emery; Brown, 1948, *Trans Am. ent. Soc.* **74** : 112–114. [Raised to genus.]

Mandibles triangular with strong horizontal basal borders which are not covered by the clypeus at full closure. Antennae 6-segmented; antennal scrobes present. Head devoid of hairs except for two on the posterodorsal surface and five or six on each antennal scape. Sides of pronotum strongly marginate.

A tramp ant spread by human commerce, *T. membranifera* Emery occurs in many parts of the tropics and warm temperate zones. Brown (1949*a*) states that the

species is probably of African origin, but the species has not yet been recorded from Africa. Wilson & Taylor (1967) report that 'The species has an ecological amplitude unusual for a dacetine, nesting in major habitats from dense woodland to dry, open cultivated fields.' In view of the above, *Trichoscapa* is included in the present work.

Tribe **LEPTOTHORACINI**

ADELOMYRMEX Emery

Adelomyrmex Emery, 1897, *Természetr. Fuz.* **20** : 590. Type-species: *Adelomyrmex biroi* Emery, 1897, loc. cit., by monotypy.

Mandibles subtriangular, dentate and with a single tooth on the basal internal margin. Maxillary palp with a single segment (Gotwald, 1969). Median portion of clypeus projecting over the basal borders or the mandibles when fully closed. Antennae 12-segmented with a funicular club of two segments, of which the apical segment is much the larger. Eyes small, situated just anterior to the midline of the side of the head. Promesonotal suture absent; metanotal groove impressed. Propodeum armed with a pair of spines.

Recovered from Berlese funnel samples of leaf-litter from the forest zone, it is probable that this genus has been spread by human commerce from the Papuan region to West Africa.

LEPTOTHORAX Mayr

Leptothorax Mayr, 1855, *Verh. zool.-bot. Ges. Wien* **5** : 431. Type-species: *Formica acervorum* Fabricius, 1804, *Syst. Piez.* : 407, by designation of Wheeler, 1911.

Goniothorax Emery, 1896, *Boll. Soc. ent. Ital.* **28** : 26 [as a subgenus of *Leptothorax*], nom. preocc.

Caulomyrma Forel, 1914, *Bull. Soc. vaud. Sci. nat.* **50** : 233 [as a subgenus of *Leptothorax*]. Type-species: *Leptothorax echinatinodis* Forel, 1886, *Annls. Soc. ent. Belg.* **30** : 48, by original designation.

Limnomyrmex Arnold, 1948, *Occ. Pap. natn. Mus. Sth. Rhodesia* **2** (14) : 222. Type-species: *Limnomyrmex stramineus* Arnold, 1948, op. cit. : 223, by original designation.

Median portion of clypeus projecting over basal borders of mandibles as a broad, arcuate lobe; the posterior margins of the lateral portions of the clypeus not raised into a ridge in front of the antennal insertions. Antennae 12-segmented with a 3-segmented club; antennal scrobes absent. Eyes well developed, situated at about the midlength of the side of the head. Anterodorsal pronotal angles acute, giving a square shouldered appearance in dorsal view. Promesonotal suture absent, metanotal groove absent to weakly impressed. Propodeum bidentate or bispinose. Petiole with a very short, thick anterior peduncle. Erect setae on all dorsal surfaces of body short, thick and blunt.

Nests in rotten wood, usually embedded in leaf-litter. Foragers are found in leaf-litter, log-mould, or more rarely running about on open ground.

Superficially resembling some species of *Tetramorium, Leptothorax* may be distinguished by a combination of the characters noted above and by the fact that in *Tetramorium* the sting is equipped apicodorsally with a translucent, triangular lamelliform appendage, absent in *Leptothorax*.

MACROMISCHOIDES Wheeler

Macromischoides Wheeler, 1920, *Psyche, Camb.* **27** : 53. Type-species: *Macromischa aculeata* Mayr, 1866, *Sber. Akad. Wiss. Wien* **53**(1) : 507, by original designation.

Mandibles subtriangular with 9 to 11 teeth of varying size. Palp formula 3,2. Head narrowed in front, broadening behind to the large, protuberant eyes and narrowing posterior to the eyes. Antennae 12-segmented with a club of three segments; the scape very long, easily surpassing the occipital margin. Pronotum with a small, obtuse tubercle at each side. Promesonotal suture absent; metanotal groove impressed. Propodeum with a pair of long acute spines. Petiole with a long narrow anterior peduncle. Body with numerous long, fine pointed setae.

Arboreal, constructing nests of vegetable fragments attached to the ventral surfaces of leaves or in the axils of larger leaves. Predacious, principally nocturnal ants.

Tribe MELISSOTARSINI

MELISSOTARSUS Emery

Melissotarsus Emery, 1877, *Annali Mus. civ. Stor. nat. Giacomo Doria.* **9** : 378. Type-species: *Melissotarsus beccarii* Emery, 1877, op. cit. : 379, by monotypy.

Antennae 6-segmented with a two-segmented club, scapes very short, extending about half the distance from their insertions to the occipital margin. Antennal scrobes absent. Eyes well developed, situated anterolaterally and noticeably longer than broad. Dorsum of alitrunk devoid of sutures, smoothly convex in profile; propodeum unarmed. Postpetiole very broadly attached to gaster posteriorly. Coxae of middle and hind legs very large, much larger than fore coxae. Basal (first) segment of tarsi enlarged, as broad as or broader than the tibiae; remaining tarsal segments small.

These uncommon ants nest under the bark of trees, usually some distance above the ground. They are sluggish and often feign death when disturbed, and are only rarely seen outside the nest during the day.

Tribe MERANOPLINI

CALYPTOMYRMEX Emery

Calyptomyrmex Emery, 1887, *Annali Mus. civ. Stor. nat. Giacomo Doria.* **25** : 471. Type-species: *Calyptomyrmex beccarii* Emery, 1887, op. cit. : 472, by monotypy.

Weberidris Donisthorpe, 1948, *Entomologist's mon. Mag.* **84** : 281. Type-species: *Weberidris rufobrunnea* Donisthorpe, 1948, loc. cit., by original designation.

Median portion of clypeus vertical, projecting anterodorsally as a bilobed structure, overhanging the mandibles. Antennae 11- or 12-segmented, with a three-segmented club. Antennal scrobes present above the eyes, very deep and capable of containing the whole antenna. Dorsum of alitrunk devoid of sutures, promesonotum convex in profile, the propodeum sloping (sometimes steeply) and armed with a pair of spines or teeth. Dorsal surfaces of body usually with spatulate or otherwise bizarre setae.

Cryptic species, usually nesting in very rotten wood deeply embedded in the ground, or in compressed leaf-litter. Foragers are found in log- and leaf-mould and occasionally in the soil beneath rotten twigs and stones.

MERANOPLUS F. Smith

Meranoplus F. Smith, 1854, *Trans ent. Soc. Lond.* (2) **2** : 224. Type-species: *Cryptocerus bicolor* Guérin, 1845, *Iconog. Règn. Anim.* **7** : 425, by designation of Bingham, 1903.
Cryptocephalus Lowne, 1865, *Entomologist* **2** : 336. Type-species: *Cryptocerus pubescens* F. Smith, 1853, *Trans ent. Soc. Lond.* (2) **2** : 223, by monotypy.

Antennae 9-segmented with a 3-segmented club. Antennal scrobes present, deep; the eyes well developed and situated towards the posterior end of the scrobe on its ventral border. Promesonotum fused, strongly margined all round and projecting posteriorly as a shelf, overhanging the propodeum which is vertical or nearly so. Posterior margin of the promesonotal shelf armed with a number of teeth or spines. Propodeum unarmed or bidentate or bispinose. Petiole and postpetiole squamiform. Head, alitrunk and gaster clothed with abundant long, soft setae, giving the ant a furry appearance to the naked eye.

The forest species usually nest directly into the ground or amongst the roots of low plants, and forage in the leaf-litter and below rotten logs. Savannah species adopt similar nesting sites but are much more active in the open and are often to be seen running on termite mounds.

Tribe **MYRMECININI**

ATOPOMYRMEX E. André

Atopomyrmex E. André, 1889, *Revue Ent.* **8** : 226. Type-species: *Atopomyrmex mocquerysi* E. André, 1889, op. cit. : 227, by monotypy.

Polymorphic. Palp formula 4,3. Antennae 12-segmented with a club of three segments. Antennal scrobes absent. Eyes well developed, flat, situated on the posterior half of the sides of the head. Pronotum marginate laterally, the promesonotal suture absent. Mesonotum bituberculate behind. Metanotal groove impressed; propodeum armed with a pair of long spines. Petiole armed with a pair of spines above.

Arboreal ants, nesting in the wood of large trees, usually a considerable distance above the ground.

PRISTOMYRMEX Mayr

Pristomyrmex Mayr, 1866, *Verh. zool.-bot. Ges. Wien* **16** : 903. Type-species: *Pristomyrmex pungens* Mayr, 1866, op. cit. : 904, by monotypy.
Odontomyrmex E. André, 1905, *Revue Ent.* **24** : 207 [as a subgenus of *Pristomyrmex*]. Type-species: *Pristomyrmex* (*Odontomyrmex*) *quadridentatus* E. André, 1905, loc. cit., by monotypy.
Hylidris Weber, 1941, *Ann. ent. Soc. Am.* **34** : 190. Type-species: *Hylidris myersi* Weber 1941, loc. cit., by original designation.
Dodous Donisthorpe, 1946, *Proc. R. ent. Soc. Lond.* (B)**15** : 145. Type-species: *Dodous trispinosus* Donisthorpe, 1946, loc. cit., by original designation.

Palp formula 1,3 or 2,3. Median portion of clypeus with a number of blunt teeth on the anterior margin; lateral portions reduced to a thin raised strip in front of the antennal insertions. Antennae 11-segmented with a 3-segmented club. Eyes medium or small, situated at about the midlength of the head; the head itself broader in front than behind, the sides convex. Dorsum of alitrunk devoid of sutures. Pronotum usually armed with a pair of spines of blunt tubercles, very rarely unarmed. Propodeum bispinose or bidentate. Sting simple, without a spatulate appendage.

Nests in rotten wood or fallen twigs in the leaf-litter; foraging is carried out in the leaf-litter or beneath the bark of fallen trees. This genus may be confused

with some species of the genus *Xiphomyrmex* which are superficially similar but in *Xiphomyrmex* the clypeal margin and pronotum are unarmed, and the sting has a spatulate apical portion.

TERATANER Emery

Irateraner Emery, 1912, *Annls Soc. ent. Belg.* **61** : 103. Type-species: *Atopomyrmex foreli* Emery, 1899, *Boll. Soc. ent. Ital.* **31** : 274, by original designation.

Antennae 12-segmented with a three-segmented club. Antennal scrobes absent. Palp formula 4,3. Pronotum anteriorly, and promesonotum laterally marginate. Promesonotal suture absent but lateral margination broken at junction of pro- and mesonotum. Metanotal groove weakly impressed; propodeum unarmed, metapleural lobes present. Petiole with a pair of teeth above.

Arboreal, nesting in the trunk or branches of living trees; foraging wholly arboreal, the ants of this genus are never found on the ground under normal circumstances.

Tribe **MYRMICARIINI**

MYRMICARIA Saunders

Myrmicaria Saunders, 1841, *Trans ent. Soc. Lond.* **3** : 57. Type-species: *Myrmicaria brunnea* Saunders, 1841, loc. cit., by monotypy.

Heptacondylus F. Smith, 1857, *J. Proc. Linn. Soc.* **2** : 71. Type-species: *Heptacondylus subcarinatus* F. Smith, 1857, op. cit.: 73, by designation of Wheeler, 1911.

Physatta F. Smith, 1857, *J. Proc. Linn. Soc.* **2** : 77. Type-species: *Physatta dromedarius* F. Smith, 1857, op. cit.: 78, by monotypy.

Palp formula 3,3. Antennae 7-segmented, indistinctly clubbed. Frontal carinae widely separated; antennal scrobes absent. Eyes placed behind midlength of head. Anterolateral angles of pronotum drawn out into a tooth on each side. Promesonotal suture represented by a weak impression which does not break the sculpture. Mesonotum bluntly bituberculate behind, sharply angled, the posterior portion more or less vertical. Metanotal groove deeply impressed; propodeum bispinose. Petiole with a long anterior peduncle. Sting coarse, somewhat flattened from side to side. Head, body and appendages with numerous long, coarse, darkly coloured setae.

Mostly savannah species. Nests are made directly into the earth, often with long sunken runways visible on the surface of the ground. The ants are active in brightest sunlight and are general predators and scavengers. In life the peduncle of the petiole is held almost vertically so that the gaster points almost straight down from base to apex, giving the ant a peculiarly foreshortened appearance.

Tribe **MYRMICINI**

CRATOMYRMEX Emery

Cratomyrmex Emery, 1891, *Annls Soc. ent. Fr.* **60** : 572. Type-species: *Cratomyrmex regalis* Emery, 1819, loc. cit., by monotypy.

Answering to the description of *Messor* below but with the tibial spurs of the middle and hind legs pectinate.

The genus is confined to savannah regions, having the same nesting sites and habits as *Messor*.

Tribe **OCHETOMYRMICINI**

WASMANNIA Forel

Wasmannia Forel, 1893, *Trans ent. Soc. Lond.* : 383. Type-species: *Tetramorium auropunctatum* Roger, 1863, *Berl. ent. Z.* **7** : 182, by designation of Wheeler, 1911.
Hercynia Enzmann, 1947, *Jl N.Y. ent. Soc.* **55** : 43. Type-species: *Hercynia panamana* Enzmann, 1947, op. cit. : 44, by original designation.

Minute ants, 2 mm or less in total length. Palp formula 3,2 (Gotwald, 1969). Antennae 11-segmented with a three-segmented club. Antennal scrobes present, bounded below by a weak longitudinal carina running above the eye. Anterodorsal angles of the pronotum acute; pronotum strongly marginate anteriorly. Promesonotal suture absent; metanotal groove weakly impressed. Propodeum bispinose; metapleural lobes present.

A single species, *W. auropunctata* (Roger,) of this neotropical genus has been introduced into Cameroun, where in places it is quite successful. It has not yet been reported as being successfully introduced into West Africa. The minute workers forage arboreally and tend aphids and coccids as well as being active predators.

Tribe **PHEIDOLINI**

MESSOR Forel

Messor Forel, 1890, *Annls Soc. ent. Belg.* **34** C.R. : 68 [as a subgenus of *Aphaenogaster*]. Type-species: *Formica barbara* Linnaeus, 1767, *Syst. Nat.* ed. **12**,2 : 962, by designation of Bingham 1903.
Messor Forel; Emery, 1908, *Dt. ent. Z.* : 437. [Raised to genus.]

Polymorphic. Mandibles strongly curved, usually dentate in smaller workers, more or less edentate in larger. Head as broad as or broader then long; eyes situated in the middle of the sides of the head. Antennae 12-segmented, without a differentiated club. Gular surface of head with a psammophore. Promesonotal suture present; metanotal groove impressed. Pronotum and mesonotum together dome-shaped in profile, the propodeum more or less flat and considerably depressed, on a much lower level than the apex of the promesonotal 'dome,. Propodeum with a pair of blunt teeth. Node of petiole emarginate above in large workers, this character may be reduced or absent in small workers. Spurs of middle and hind tibiae simple.

Restricted to the savannah regions of West Africa and also occurring on the coastal plains. Nests are made directly into the earth in open ground, and have a crater-like entrance.

PHEIDOLE Westwood

Pheidole Westwood, 1840, *Ann. Mag. nat. Hist.* **6** : 87. Type-species: *Atta providens* Sykes, 1835, *Trans. ent. Soc. Lond.* **1** : 103, by designation of Bingham, 1903.
Leptomyrma Motschulsky, 1863, *Bull. Soc. Nat. Moscou* **36** : 17. Type-species: *Leptomyrma gracilipes* Motschulsky, 1863, loc. cit., by monotypy.
Epipheidole Wheeler 1903, *Bull. Am. Mus. nat. Hist.* **19** : 664. Type-species: *Epipheidole inquilina* Wheeler 1903, loc. cit., by monotypy.

Dimorphic, rarely with intermediates. Major worker (soldier) with head massive, the occipital margin deeply impressed in the middle. Mandibles large, heavy, strongly curved, each usually armed with three teeth, of which two are situated apically and one basally on the masticatory

margin and separated by a diastema. Palp formula 2,2 in species examined. Antennae 12-segmented with a 3-segmented club. Eyes situated in front of the midlength of the side of the head. Promesonotal suture absent or represented by an impressed line, rarely present. Metanotal groove deeply impressed. Propodeum armed with a pair of spines or teeth; petiole usually emarginate above.

Minor worker with occipital margin of head shallowly emarginate or more usually with the sides of the head converging behind the eyes so that the occipital margin is very short. Mandibles usually with two or three large teeth apically followed by a row of denticulae of uneven sizes. Palp formula and antennae as in major worker but eyes usually set just in front of midlength of the head. Alitrunk and pedicel as above.

A very common genus in West Africa, present throughout the region and nesting in rotten wood, directly into open ground, under stones and logs, amongst the roots of plants and occasionally beneath the bark of standing trees or in rot-holes in tree trunks.

Tribe **SOLENOPSIDINI**

CAREBARA Westwood

Carebara Westwood, 1841, *Ann. Mag. nat. Hist.* **6** : 86. Type-species: *Carebara lignata* Westwood, 1841, loc. cit., by monotypy.

Mandibles with five or six teeth. Palp formula 2,2 (Ettershank, 1966). Antennae 9-segmented with a club of two segments. Clypeus bicarinate; eyes completely absent. Promesonotal suture absent; metanotal groove impressed. Propodeum unarmed.

Workers minute, usually less than 2 mm total length; depigmented, usually yellow in colour.

The ants of this genus are wholly hypogaeic and are nearly always found with termites. Their nests are usually built in the walls of termitaria of species which do not show a mound above ground-level. Occasional workers are found in Berlese funnel samples. At the times when alate females and males are produced, the workers emerge in hundreds onto the surface of the ground.

DIPLOMORIUM Mayr

Diplomorium Mayr. 1901 *Annln naturh. Mus. Wien* **16** : 16. Type-species: *Diplomorium longipenne* Mayr, 1901, op. cit. : 18, by monotypy.

Bondroitia Forel, 1911, *Bull. Soc. vaud. Sci. nat.* **47** : 398 [as a subgenus of *Diplomorium*]. Type-species: *Diplomorium lujae* Forel, 1909, *Annls Soc. ent. Belg.* **53** : 72, by monotypy.

As *Monomorium* below but always with the antennae 11-segmented and the median portion of the clypeus swollen but not bicarinate. Palp formula 2,2 (Ettershank, 1966).

The species nest in rather dry rotten wood.

MONOMORIUM Mayr

Monomorium Mayr, 1855, *Verh. zool.-bot. Ges. Wien* **5** : 452. Type-species: *Monomorium minutum* Mayr, 1855, op. cit. : 453, by monotypy.

Phacota Roger, 1862, *Berl. ent. Z.* **6** : 260. Type-species: *Phacota sicheli* Roger, 1862, op. cit.: 262, by monotypy.

Trichomyrmex Mayr, 1865, *Reise der . . . Fregatte Novara, Zool.* **2** (1) : 19. Wien. Type-species: *Trichomyrmex rogeri* Mayr, 1865, loc. cit., by monotypy.

Lampromyrmex Mayr, 1868, *Beitr. Naturk. Preuss.* **1** : 92. Type-species: *Lampromyrmex gracillimus* Mayr, 1868, nom. preocc. [= *Monomorium mayrianum* Wheeler, 1914, *Schr. phys.-ökon. Ges. Königsb.* **55** : 45. (fossil), nom. substit.], by monotypy.

Holcomyrmex Mayr, 1878, *Verh. zool.-bot. Ges. Wien* **28** : 671. Type-species: *Holcomyrmex scabriceps* Mayr, 1878, op. cit. : 672, by designation of Bingham, 1903.

Epoceus Emery, 1892, *Annls Soc. ent. Fr.* **61** : 272. Type-species: *Epoecus pergandei* Emery, 1892, op. cit. : 273, by monotypy.

Wheeleria Forel, 1905, *Annls Soc. ent. Belg.* **49** : 171, nom. preocc. Type-species: *Wheeleria santschii* Forel, 1905, loc. cit., by monotypy.

Wheeleriella Forel, 1907, *Int. Sci. Revue* **4** : 145, nom. substit. pro. *Wheeleria* Forel.

Epixenus Emery, 1908, *Dt. ent. Z.* : 556. Type-species: *Monomorium advena* Brown and Wilson, 1957, *Ent. News* **68** : 244, nom. substit. pro *Epixenus andrei* Emery, 1908 (nec Saunders, 1890).

Xeromyrmex Emery, 1915, *Bull. Soc. ent. Fr.* : 190 [as a subgenus of *Monomorium*]. Type-species: *Formica salomonis* Linnaeus, 1758, *Syst. Nat.* ed. **10** : 580, by original designation.

Parholcomyrmex Emery, 1915, *Bull. Soc ent Fr.* : 190 [as a subgenus of *Monomorium*] [= *Paraholcomyrmex*, variant spelling]. Type-species: *Myrmica gracillima* F. Smith, 1861, *J. Proc. Linn. Soc.* **5** : 34, by original designation.

Corynomyrmex Viehmeyer, 1916, *Arch. Naturgesch.* **81** : 134 [as a subgenus of *Monomorium*]. Type-species: *Monomorium (Corynomyrmex) hospitum* Viehmeyer, 1916, loc. cit., by monotypy. Provisional synonymy of Ettershank, 1966, *Aust. J. Zool.* **14** : 82.

Isolcomyrmex Santschi, 1917, *An. Soc. cient. argent.* **84** : 296 [as a subgenus of *Monomorium*]. Type-species: *Monomorium santschianum* Ettershank, 1966, nom. substit. pro *Holcomyrmex santschii* Forel, 1907, nom. preocc.

Paraphacota Santschi, 1919, *Bull. Soc. ent. Fr.* : 91. Type-species: *Phacota noualhieri* Emery, 1895, *Mem. R. Accad. Sci. Ist. Bologna* **5** : 299, by original designation.

Equestrimessor Santschi, 1919, *Bull. Soc. ent. Fr.* : 92. [as a subgenus of *Monomorium*] [= *Equesimessor*, variant spelling]. Type-species; *Holcomyrmex chobauti* Emery, 1897, *Bull. Soc. ent. Fr.* : 418, by designation of Donisthorpe, 1943, *Ann. Mag. nat. Hist.* (11) **10** : 644.

Xenhyboma Santschi, 1919, *Boln Soc. esp. Hist. nat.* **19** : 405. Type-species: *Xenhyboma mystes* Santschi, 1919, loc. cit., by monotypy. Provisional synonymy of Ettershank, 1966, *Aust. J. Zool.* **14** : 82.

Ireneidris Donisthorpe, 1943, *Entomologist's mon. Mag.* **79** : 81. Type-species: *Ireneidris myops* Donisthorpe, 1943, loc. cit. [=*Monomorium talpa* Emery, 1911, *Nova Guinea* **9** : 252], by original designation.

Median portion of clypeus with two distinct longitudinal carinae, the clypeus sometimes concave between the carinae on the anterior margin and projecting as a pair of blunt teeth. Palp formula 1,2 or 2,2 (Ettershank, 1966). Eyes present. Antennae 11- or 12-segmented with a 3-segmented club. Promesonotal suture absent on dorsum of alitrunk; metanotal groove impressed. Propodeum unarmed; petiole pedunculate, the node high and rounded.

The majority of West African species of this very common genus are unsculptured, smooth and shiny ants, but some have a universal fine dense puncturation or reticulo-puncturation. Nests are made in rotten wood, under stones or directly into the earth. *M. pharaonis* (L.) is a common house-inhabiting species.

OLIGOMYRMEX Mayr

Oligomyrmex Mayr, 1867, *Tijdschr. Ent.* **10** : 110. Type-species: *Oligomyrmex concinnus* Mayr, 1867, op. cit.: 111, by monotypy.

Aeromyrma Forel, 1891, *Annls Soc. ent. Belg.* **35**: 307. Type-species: *Aeromyrma nosindambo* Forel, 1891, op. cit. : 199, by monotypy.

Aneleus Emery, 1900, *Termeszetr. Füz.* **23** : 327 [as a subgenus of *Pheidologeton.*] Type-species: *Solenopsis similis* Mayr, 1862, *Verh. zool.-bot. Ges. Wien* **12** : 751, by designation of Wheeler, 1911.

Erebomyrma Wheeler, 1903, *Biol. Bull. mar. biol. Lab. Woods Hole* **4** : 138. Type-species: *Erebomyrma longi* Wheeler, 1903, op. cit. : 140, by monotypy.

Lecanomyrma Forel, 1913, *Zool. Jb.* Syst. **36** : 56 [as a subgenus of *Pheidologeton*]. Type-species: *Pheidologeton* (*Lecanomyrma*) *butteli* Forel, 1913, loc. cit., by designation of Emery, 1922.

Octella Forel, 1915, *Ark. Zool.* **9** : 69 [as a subgenus of *Oligomyrmex*]. Type-species: *Oligomyrmex* (*Octella*) *pachycerus* Forel, 1915, loc. cit., by original designation.

Spelaeomyrmex Wheeler, 1922, *Am. Mus. Novit.* no. **45** : 9. Type-species: *Spelaeomyrmex urichi* Wheeler, 1922, loc. cit., by original designation.

Hendecatella Wheeler, 1927, *Boll. Lab. Zool. gen. agr. Portici* **20** : 93 [as a subgenus of *Oligomyrmex*] Type-species: *Oligomyrmex* (*Hendecatella*) *capreolus* Wheeler, 1927, loc. cit., by monotypy.

Solenops Karawajew, 1930, *Zool. Anz.* **92** : 207 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis* (*Solenops*) *weyeri* Karawajew, 1930, loc. cit., by monotypy (nec *Solenops* Dufour, 1820, Arachnida).

Sporocleptes Arnold, 1948, *Occ. Pap. natn. Mus. Sth Rhod.* **2** (14): 219. Type-species: *Sporocleptes nicotiana* Arnold, 1948, loc. cit., by original designation.

Crateropsis Patrizi, 1948, *Boll. Ist. Ent. Univ. Bologna* **17** : 174 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis* (*Crateropsis*) *elementeitae* Patrizi, 1948, loc. cit., by original designation. Provisional synonymy of Ettershank, 1966, *Aust. J. Zool.* **14** : 120.

Nimbamyrma Bernard, 1952, *Mém. Inst. franç. Afr. noire* **19** : 240. Type-species: *Nimbamyrma villiersi* Bernard, 1952, op. cit. : 241, by monotypy. Provisional synonymy of Ettershank, 1966, *Aust. J. Zool.* **14** : 120.

Median portion of clypeus longitudinally bicarinate. Palp formula 2,2 in major workers (Ettershank, 1966). Antennae 9-, 10- or 11- segmented with a club of two segments. Eyes present, small. Promesonotal suture absent from dorsum of alitrunk; metanotal groove impressed. Propodeum armed with a pair of teeth or at least sharply angulate. Dimorphic species without intermediates, the major workers with massive heads.

Ants of this genus are small to minute and usually nest in rotten wood to which the bark is still adherent. Workers are quite common in Berlese samples of leaf litter and have been found in epiphytic moss on trees.

PAEDALGUS Forel

Paedalgus Forel, 1911, *in* Escherich, *Termitenleben auf Ceylon* : 217. Jena. Type-species: *Paedalgus escherichi* Forel, 1911, op. cit. : 218, by monotypy.

Mandibles with four teeth. Palp formula 2,2, (Ettershank, 1966). Clypeus longitudinally bicarinate. Eyes present, minute, of two ommatidia only. Antennae 9-segmented with club of two segments. Promesonotal suture absent; metanotal groove not impressed. Dorsum of alitrunk with sharp lateral margins; propodeum unarmed.

Minute yellowish ants nesting in the walls of termitaria or rotten wood infested by termites.

PHEIDOLOGETON Mayr

Pheidologeton Mayr, 1862, *Verh. zool.-bot. Ges. Wien* **12** : 750. Type-species: *Oecodoma diversa* Jerdon, 1851, *Madras J. Lit. & Sci.* **17** : 109, by designation of Bingham, 1903.

Amauromyrmex Wheeler, 1929, *Am. Mus. Novit.* no. **349** : 1. Type-species: *Amauromyrmex speculifrons* Wheeler, 1929, loc. cit. [= *Pheidologeton silenus* (F. Smith, 1858)], by original designation.

Idrisella Santschi, 1937, *Annls Soc. ent. Belg.* **77** : 372. Type-species: *Pheidologeton dentiviris* Forel, 1913, *Arch. Naturgesch.* **79** : 192, by original designation.

Polymorphic. Mandibles of major workers often edentate or with reduced, rounded teeth; minor workers with five or six teeth. Palp formula 2,2 (Ettershank, 1966). Clypeus not bicarinate. Eyes present. Antennae 11-segmented with a 2-segmented club. Promesonotal suture absent in minor workers, becoming increasingly developed with increased worker size. Metanotal groove impressed; propodeum bispinose.

Nests in and under rotten logs; uncommon in West Africa.

SOLENOPSIS Westwood

Solenopsis Westwood, 1841, *Ann. Mag. nat. Hist.* **6** : 87. Type-species: *Solenopsis mandibularis* Westwood, 1841 [= *Atta geminata* Fabricius, 1804, *Syst. Piez.* : 243], by monotypy.

Diplorhoptrum Mayr, 1855, *Verh. zool.-bot. Ges. Wien* **5** : 449. Type-species: *Formica fugax* Latreille, [1798], *Essai . . . Fourmis de la France* : 46, Brive, by monotypy.

Synsolenopsis Forel, 1918, *Bull. Soc. vaud. Sci. nat.* **52** : 155 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis bruchiella* Emery, 1921, *Genera Insect.* Myrmicinae, fasc. **174A**: 199, nom. substit., pro *Solenopsis bruchi* Forel, 1918 (nec *Solenopsis bruchi* Forel, 1912), by monotypy.

Diagyne Santschi, 1923, *Revue suisse Zool.* **30** : 267 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis succinea* Emery, 1890, *Boll. Soc. ent. Ital.* **22** : 52, by original designation.

Labauchena Santschi, 1930, *Revta Soc. ent. argent.* **13** : 81. Type-species: *Labauchena daguerrei* Santschi, 1930, loc. cit., by monotypy.

Euophthalma Creighton, 1930, *Proc. Am. Acad. Arts Sci.* **66** : 43 [as a subgenus of *Solenopsis*]. Type-species: *Myrmica globularia* F. Smith, 1858, *Cat. Hym. Brit. Mus.* **6** : 131, by original designation.

Oedaleocerus Creighton, 1930, *Proc. Am. Acad. Arts Sci.* **66** : 43 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis angulata* Emery, 1894, *in* von Ihering, *Berl. ent. Z.* **39** : 393, by original designation.

Bisolenopsis Kusnezov, 1953, *Acta Zool. lilloana* **13** : 1. Type-species *Bisolenopsis sea* Kusnezov, 1953, loc. cit., by monotypy.

Paranamyrma Kusnezov, 1954, *Mems Mus. Entre Rios* **30** : 9. Type-species: *Paranamyrma solenopsidis* Kusnezov, 1954, op. cit. : 12, by monotypy.

Lilidris Kusnezov, 1957, *Zool. Anz.* **158** : 268, 274. Type-species: *Lilidris metatarsalis* Kusnezov, 1957, loc. cit., by monotypy.

Granisolenopsis Kusnezov, 1957, *Zool. Anz.* **158** : 270, 277 [as a subgenus of *Solenopsis*]. Type-species: *Solenopsis* (*Granisolenopsis*) *granivora* Kusnezov, 1957, op. cit. : 278, by monotypy.

Monomorphic or polymorphic. Mandibles with three or four teeth. Palp formula 1,2, the maxillary palp geniculate (Ettershank, 1966). Clypeus strongly longitudinally bicarinate, the median area sharply elevated and deeply inserted between the frontal carinae. Antennae 10-segmented with a 2-segmented club. Promesonotal suture absent from dorsum of alitrunk; metanotal groove impressed; propodeum unarmed.

The genus is represented by only three or four indigenous species in West Africa, which are small yellowish ants nesting in soil at the bases of trees or in the leaf-litter. The species are general scavengers and are often found on dead insects lying in the leaf-litter at the bases of trees. One species, *S. geminata* (Fabricius) has been introduced to West Africa from the neotropical region. It is very common in the Warri Delta in Nigeria, where it is called 'okubrass'.

SYLLOPHOPSIS Santschi

Syllophopsis Santschi, 1915, *Annls Soc. ent. Fr.* **84** : 259 [as a subgenus of *Monomorium*]. Type-species: *Monomorium modestum* Santschi, 1914, *Meddn Göteborgs Mus. Zool. Afd.* **3** : 17, by monotypy.
Syllophopsis Santschi; Santschi, 1921, *Annls Soc. ent. Belg.* **61** : 120. [Raised to genus.]

As *Monomorium* but median portion of clypeus somewhat swollen, without longitudinal carinae. Antennae always 12-segmented with a 3-segmented club.

Tribe TETRAMORIINI

DECAMORIUM Forel

Decamorium Forel, 1913, *Annls Soc. ent. Belg.* **62** : 121 [as a subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Decamorium*) *decem* Forel, 1913, loc. cit., by monotypy.
Decamorium Forel; Wheeler, 1922*d*, *Bull. Am. Mus. nat. Hist.* **45** : 906. [Raised to genus.]

Mandibles with five to six teeth; palp formula 4,3. Sides of median portion of clypeus and posterior margins of the lateral portions raised, bordering the antennal insertions. Antennae 10-segmented with a 3-segmented club. Antennal scrobes present above the eyes, the ventral margins of the scrobes very poorly defined. Anterodorsal pronotal angles acute; promesonotal suture absent from dorsum of alitrunk. Metanotal groove impressed; propodeum armed with a pair of teeth, metanotal lobes present. Sting with a triangular lamelliform appendage apicodorsally. Femora of legs swollen.

The single species *D. decem* (Forel) nests in rotten logs or twigs buried in the leaf-litter. Foragers often leave the nest and progress through the leaf-litter in single file. The species has been observed preying on termites.

RHOPTROMYRMEX Mayr

Rhoptromyrmex Mayr, 1901, *Annln naturh. Mus. Wien* **16** : 18. Type-species: *Rhoptromyrmex globulinodis* Mayr, 1901, op. cit. : 20, by designation of Wheeler, 1911.
Acidomyrmex Emery, 1915, *Bull. Soc. ent. Fr.* **1915** : 191 [as a subgenus of *Rhoptromyrmex*]. Type-species: *Rhoptromyrmex wroughtonii* Forel, 1902, *Revue suisse. Zool.* **10** : 231, by original designation.

Palp formula 3,2 (Brown, 1964). Posterior margins of lateral portions of clypeus raised into ridges in front of antennal insertions. Antennae twelve-segmented with a three-segmented club. Frontal carinae short, divergent behind; antennal scrobes absent. Sutures absent on dorsum of alitrunk, but metanotal groove usually visible. Propodeum unarmed in African species.

Collections of *Rhoptromyrmex* species in West Africa are uncommon but occasionally occur in leaf-litter samples, usually from the forest zone.

TETRAMORIUM Mayr

Tetramorium Mayr, 1855, *Verh. zool.-bot. Ges. Wien* **5** : 423. Type-species: *Formica caespitum* Linnaeus, 1758, *Syst. Nat.*, ed. **10** : 581, by designation of Girard, 1879.
Tetrogmus Roger, *Berl. ent. Z.* **1** : 10. Type-species: *Tetrogmus caldarius* Roger, 1857, op. cit.: 12 [= *Myrmica simillima* F. Smith, 1851], by monotypy.

Mandibles with three or four large teeth apically, followed by a variable number of denticulae. Palp formula 4,3. Posterior margins of lateral portions of clypeus raised into a ridge bordering

the antennal insertions. Antennae 12-segmented with a 3-segmented club. Antennal scrobes absent to feebly present; the frontal carinae often extended backwards as a pair of diverging rugae which may run to the occipital margin of the head. Anterolateral angles of the pronotum characteristically sharply angulate, giving a square-shouldered appearance in dorsal view. Sutures absent from dorsum of alitrunk, although the metanotal groove is usually impressed. Propodeum armed with a pair of spines or teeth, metapleural lobes present, acute, may project as a pair of spines below those of the propodeum. Sting with an apicodorsal triangular lamelliform appendage. Femora of legs usually distinctly swollen. Setal development not as in *Triglyphothrix* below.

Common ants varying from medium to small in size. Usually nesting in rotten wood or in compressed leaf-litter, but a few species nest directly into open ground, some are arboreal and some are termitolestic. The *T. sericeiventre* Emery group of species includes elongate, long-legged ants making crater nests in open ground. They are mostly confined to savannah but also occur in forest clearings and on paths. *T. termitobium* Emery and allies are small species usually found nesting in rotten logs with termites, or in the walls of termitaria.

TRIGLYPHOTHRIX Forel

Triglyphothrix Forel, 1890, *Annls Soc. ent. Belg.* **34** : 106. Type-species: *Triglyphothrix walshi* Forel, 1890, op. cit. : 107, by monotypy.

As *Tetramorium* above but antennal scrobes usually well developed, deep and divided into upper and lower compartments by a longitudinal ridge. Setae trifid or multifid, best observed by viewing the alitrunk and pedicel in profile at magnifications of 80 ×or more. Hairs usually abundant, giving the ant a furry appearance to the naked eye.

In a few species the antennal scrobes are poorly developed but in these the trifid hair character is apparent.

Leaf-litter and ground foraging species nesting directly into the soil or in rotten wood.

XIPHOMYRMEX Forel

Xiphomyrmex Forel, 1887, *Mitt. schweiz. ent. Ges.* **7** : 385 [as a subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Xiphomyrmex*) *kelleri* Forel, 1889, loc. cit., by designation of Wheeler, 1911.

Xiphomyrmex Forel; Wheeler, 1922, *Bull. Am. Mus. nat. Hist.* **45** : 906. [Raised to genus.]

As *Tetramorium* above but antennae 11-segmented with a 3-segmented club. Antennal scrobes usually better developed, at least with a distinct dorsal boundary. Palp formula usually 4,3 ,rarely reduced to 3,3. Sting with a spatulate appendage apically, projecting from the body of the sting at a shallow angle.

A number of species completely lack sculpture and are highly polished, usually jet-black, but most species have the head and alitrunk with some sculpturation. In some species one or both segments of the pedicel may be squamiform, this character usually corresponding to loss of sculpture.

Nests are made in rotten wood and foragers are quite common in the leaf-litter and in log-mould.

Subfamily **DORYLINAE**

Tribe **AENICTINI**

AENICTUS Shuckard

Aenictus Shuckard, 1840, *Ann. nat. Hist.* **5** : 266. Type-species: *Aenictus ambiguus* Shuckard, 1840, loc. cit., by original designation.

Typhlatta F. Smith, 1857, *J. Proc. Linn. Soc.* **2** : 79. Type-species: *Typhlatta laeviceps* F. Smith, 1857, loc. cit., by monotypy.

Paraenictus Wheeler, 1929, *Boll. Lab. Zool. gen. agr. Portici* **24** : 27 [as a subgenus of *Aenictus*]. Type-species: *Aenictus* (*Paraenictus*) *silvestrii* Wheeler, 1929, op. cit. : 28, by monotypy.

Palp formula 2,2 (Gotwald, 1969). Posterior margin of clypeus and lobes of frontal carinae raised, forming a ridge around the antennal insertions, which are exposed in dorsal view. Gena laterad of each antennal insertion with a carina of variable length. Antennae ten-segmented. Eyes absent. Dorsum of alitrunk without sutures, metanotal groove usually impressed. Pedicel of two segments, the petiole usually sessile in front. Pygidium not impressed, without teeth or spines.

Small to medium sized ants, yellowish or reddish brown in colour, often with large areas of cuticle unsculptured, especially on the head, pronotum and gaster. The ants follow an 'army ant' lifeway and their narrow marching columns are quite common in the leaf-litter layer. They may also be found in and under rotten logs, under bark, and amongst the roots of trees and bushes.

Tribe **DORYLINI**

DORYLUS Fabricius

Dorylus Fabricius, 1793, *Ent. Syst.* **2** : 365. Type-species: *Vespa helvola* Linnaeus, 1764, *Mus. Ludov. Ulr.* : 412, by designation of Shuckard, 1840, *Ann. nat. Hist.* **5** : 315.

Sphegomyrmex Imhoff, 1852, *Verh. naturf. Ges. Basel* **10** : 175. Type-species: *Dorylus nigricans* Illiger, 1802, *Magazin Insectenk.* **1** : 188, by monotypy.

Cosmaecetes Spinola, 1853, *Memorie Accad. Sci. Torino* (2) **13** : 70. Type-species: *Cosmaecetes homalinus* Spinola, 1853, op. cit. : 71 [= *Typhlopone fulva* Westwood 1840, *Introd. Class. Insects* **2** : 219], by monotypy.

Shuckardia Emery, 1895, *Zool. Jb.* Abt. Syst. **8** : 703, 740. Type-species: *Alaopone abeilli* E. André, 1885 [= *Dorylus atriceps* Shuckard, 1840, *Ann. nat. Hist.* **5** : 323], by original designation.

Polymorphic. Mandibles with apical tooth long and acute, with at least one other tooth on the inner margin, usually with more. Larger workers have fewer teeth than smaller forms. Palp formula 2,2 (Gotwald, 1969). Frontal carinae vertical, the condylar bulbs of the antennae exposed. Antennae 9-, 10- or 11-segmented; eyes absent. Genae not longitudinally carinate. Promesonotal suture present, mobile; metanotal groove absent. Pedicel of a single segment, the first gastral segment somewhat reduced, smaller than the second segment. Pygidium impressed, armed at each side with a tooth or spine.

The larger species, placed in the subgenus *Anomma* Shuckard, are the well known Driver Ants, their trails often being seen crossing paths where covered runways are built by the ants to shield them from direct sunlight.

Numerous species in other subgenera are never seen on the surface of the ground by day. They are found in rotten logs, tree-stumps, leaf-litter and termitaria and occasionally under bark or in the earth beneath stones and logs. All species are carnivorous and indulge in nomadism and group predation.

Subfamily **LEPTANILLINAE**

Tribe **LEPTANILLINI**

LEPTANILLA Emery

Leptanilla Emery, 1870, *Boll. Soc. ent. Ital.* **2** : 196. Type-species: *Leptanilla revelierii* Emery, 1870, loc. cit., by monotypy (nec *Leptanilla* Holmgren, 1908).

Frontal carinae raised so that the condylar bulbs of the antennae are exposed in dorsal view. Antennae 12-segmented. Eyes absent; genae not carinate. Promesonotal suture present, metanotal groove absent. Pedicel of two segments. Pygidium not impressed nor armed with spines or teeth laterally.

Minute ants usually with a total length of less than 1·5 mm. Depigmented, colour yellow.

These very small ants carry out an army ant lifeway in the soil and are probably predacious on the interstitial fauna of the soil. At present known only from Ghana where they were recovered from a Berlese funnel sample taken from a cocoa farm in the eastern region of that country.

Subfamily **PSEUDOMYRMECINAE**

Tribe **PSEUDOMYRMECINI**

PACHYSIMA Emery

Pachysima Emery, 1912, *Annls Soc. ent. Belg.* **61** : 97 [as a subgenus of *Sima*]. Type-species: *Tetraponera aethiops* F. Smith, 1877, *Trans. ent. Soc. Lond.* : 71, by original designation.

Pachysima Emery; Donisthorpe, 1916, *Entomologist's Rec. J. Var.* **28** : 242. [Raised to genus.]

Mandibles with four or five teeth; palp formula 5,4. Antennae 12-segmented without a differentiated club. Eyes well developed occupying about one third of the length of the side of the head and situated behind the midlength of the head. Three well developed ocelli present. Promesonotum distinct, metanotum present as a sclerite on the dorsum of the alitrunk. Middle and hind legs with one large pectinate and one small simple spur; claws armed with a tooth close to the apex. Petiole and postpetiole each with acute ventral processes.

Black ants, medium to large in size (total length 7 to 14 mm), living usually in plants of the genus *Barteria*, and tending large coccids on the plant.

TETRAPONERA F. Smith

Tetraponera F. Smith, 1852, *Ann. Mag. nat. Hist.* (2) **9** : 44. Type-species: *Tetraponera atrata* F. Smith, 1852, loc. cit. [= *Eciton nigrum* Jerdon, 1851, *Madras J. Lit. Soc.* **17** : 111], by designation of Wheeler, 1911.

Sima Roger, 1863, *Berl. ent. Z.* **7** : 178. Type-species: *Sima compressa* Roger, 1863, op. cit. : 179 [= *Pseudomyrma*? *allaborans* Walker, 1860], by monotypy.

As *Pachysima* above but slender, more elongate ants with proportionally shorter legs. Clypeus sometimes produced into a spine or armed with a row of teeth or with a crenulate anterior margin. Eyes larger than in *Pachysima*, often occupying one half the length of the side of the head. Ocelli variously developed, often absent but there may be one, two or three present. Either the petiole alone with a ventral process or both segments of the pedicel without ventral processes.

Arboreal species nesting in hollow twigs and branches, their colonies extending deep into the trunk if hollow or rotten. Foragers sometimes descend to ground level where they may be found close to the base of the trunk or on surface roots. The ants are very active with rapid jerky movements and abrupt changes of direction.

VITICICOLA Wheeler

Viticicola Wheeler, 1920, *Psyche, Camb.* **27** : 53. Type-species: *Sima tessmanni* Stitz, 1910 *Mitt. zool. Mus. Berlin* **5** : 131, by original designation.

Palp formula 3,3 (Wheeler, 1922). Antennae 12-segmented with a 3-segmented club. Eyes small, occupying less than one third of the side of the head and situated at about the midlength of the head. Anterior ocellus present or with all ocelli absent. Claws simple. Otherwise as *Pachysima* above, but decidely smaller, total length less than 7 mm.

Living only in the hollow stems of the plant *Vitex staudtii* Guerke.

Subfamily DOLICHODERINAE

Tribe TAPINOMINI

ENGRAMMA Forel

Engramma Forel, 1905, *Annls Soc. ent. Belg.* **49** : 180. Type-species: *Engramma lujae* Forel, 1905, op. cit. : 181, by monotypy.

Mandibles with apical and subapical teeth large, followed by a series of denticulae. Anterior border of median portion of clypeus deeply and strongly emarginate. Palp formula 4,3. Eyes well developed, set at or just in front of the midlength of the head and on the dorsal surface. Antennae 12-segmented. Promesonotal and metanotal sutures present on dorsum of alitrunk. Petiole reduced and overhung by the first gastral segment dorsally, invisible in dorsal view. Gaster with five segments visible in dorsal view, anal and associated orifices apical.

Wheeler (1922*b* : 202) states that most species live in the cavities of myrmecophytes but that one lives in the ground and another inhabits a woven nest mixed with vegetable fibres, attached to the trunks of trees.

IRIDOMYRMEX Mayr

Iridomyrmex Mayr, 1862, *Verh. zool.-bot. Ges. Wien* **12** : 702. Type-species: *Formica detecta* F. Smith, 1858, *Cat. Hym. Brit. Mus.* **6** : 36 [= *Formica purpurea* F. Smith, 1858], by designation of Bingham, 1903.

Doleromyrma Forel, 1907, *Annls hist.-nat. Mus. natn. hung.* **5** : 28 [as a subgenus of *Tapinoma*]. Type-species: *Tapinoma* (*Doleromyrma*) *darwinianum* Forel, 1907, loc. cit., by monotypy.

Mandibles with the two apical teeth enlarged, the remainder of the apical margin with a series of denticulae of varying sizes. Anterior clypeal margin shallowly concave. Palp formula 6,4. Eyes located on the dorsal surface of the anterior half of the head. Antennae 12-segmented. Petiole a small but distinct scale, inclined forewards but not overhung by the first gastral segment.

The single species of this genus represented on the African continent is *I. humilis* (Mayr), an introduction from the neotropical region. To the present time the species has not been successfully introduced to West Africa, although it is well established in Southern Africa.

TAPINOMA Förster

Tapinoma Förster, 1850, *Hym. Stud.* **1** : 43. Aachen. Type-species: *Tapinoma collina* Förster, 1850 [= *Formica erratica* Latreille, 1798, *Hist. Nat. Form.* : 182], by monotypy.

Micromyrma Dufour, 1857, *Annls Soc. ent. Fr.* **5** : 60. Type-species: *Tapinoma dufouri* Donisthorpe, 1943, *Ann. Mag. nat. Hist.* (11) **10** : 662.

Mandibles with apical two or three teeth large, followed by a row of denticles. Palp formula 6,4. Clypeus with or without median anterior border emarginate. Antennae 12-segmented. Eyes placed at or in front of the midlength of the side of the head on the dorsal surface. Propodeum unarmed or rarely with a pair of blunt tubercles. Petiole reduced or vestigial, overhung by the first gastral segment and not visible in dorsal view. Gaster in dorsal view with four visible tergites; anal and associated orifices ventral.

Nests under bark, in rotten wood, in compressed leaf-litter or in the soil. *T. melanocephalum* (F.) is a common species in houses in West Africa.

TECHNOMYRMEX Mayr

Technomyrmex Mayr, 1872, *Ann. Mus. civ. Stor. nat. Giacomo Doria* **2** : 147. Type-species: *Technomyrmex strenua* Mayr, 1872, loc. cit., by designation of Bingham, 1903.
Aphantolepis Wheeler, 1930, *Psyche, Camb.* **37** : 44. Type-species: *Aphantolepis quadricolor* Wheeler, 1930, loc. cit., by original designation.

As *Tapinoma* but with five gastral segments visible in dorsal view, the anal and associated orifices apical.

Subfamily **FORMICINAE**

Tribe **CAMPONOTINI**

CAMPONOTUS Mayr

Camponotus Mayr, 1861, *Europ. Formicid.* : 35. Wien. Type-species: *Formica ligniperda* Latreille, 1802, *Fourmis* : 88, by designation of Bingham, 1903.

Polymorphic. Mandibles with five to seven stout teeth. Clypeus often with median portion projecting as a truncated lobe, more obvious in larger workers. Palp formula 6,4. Antennae 12-segmented, without clubs, inserted some distance behind the posterior clypeal margin (a distance usually greater than the basal width of the scape). Frontal carinae converging anteriorly, leaving the antennal insertions only partially or not at all covered. Eyes present, usually well developed, situated behind the midlength of the head. Promesonotal suture distinct, development of other sutures variable. The mesoscutellum is often present on the dorsal surface of the alitrunk in larger workers and in some the metanotum is also present on the dorsum. Alitrunk unarmed, without spines or teeth on pronotum or propodeum, although the latter may be abruptly truncated. Petiole a node or scale, without spines or teeth. Acidopore circular, clearly visible, not concealed by the pygidium.

Common; nests are formed in rotten wood, in the earth, in rotten branches and twigs of standing trees, or directly into living wood by extending the galleries begun by wood-boring beetles. Medium to very large ants (5 to 15 mm) found in all localities. A number of species are arboreal whilst others are purely nocturnal in habits, but the majority are diurnal and terrestrial. All are active, fast-running ants with powerful mandibles.

PHASMOMYRMEX Stitz

Phasmomyrmex Stitz, 1910, *Mitt. zool. Mus. Berlin* **5** : 146. Type-species: *Phasmomyrmex sericeus* Stitz, 1910, loc. cit. [= *Camponotus buchneri* Forel, 1886, *Annls Soc. ent. Belg.* **30** : 183], by monotypy.

Monomorphic. Mandibles with five teeth. Clypeus with median portion broadly and shallowly excised. Palp formula 6,4. Antennae 12-segmented, without clubs. Insertions of antennae, form of frontal carinae and eyes as in *Camponotus*. Anterodorsal pronotal angles projecting as short teeth or with the sides strongly marginate. Metanotal groove impressed, the propodeum truncated posteriorly, unarmed. Petiole a node extended into a short dorso-lateral tooth on each side. Acidopore circular, not concealed by the pygidium.

Arboreal, nesting and foraging in trees, very rarely descending to ground level.

POLYRHACHIS F. Smith

Polyrhachis F. Smith, 1857, *J. Proc. Linn. Soc.* **2** : 58. Type-species: *Formica bihamata* Drury, 1773, *Illust. Nat. Hist.* vol. **2** : 73, by original designation.
Hoplomyrmus Gerstaecker, 1858, *Mber. dt. Akad. Wiss. Berl.* : 262. Type-species: *Hoplomyrmus schistacea* Gerstaecker, 1858, loc. cit., by monotypy.

Mandibles usually with five teeth, rarely with four. Median portion of clypeus usually projecting as a lobe, rarely broadly emarginate. Palp formula 6,4. Antennae 12-segmented, not clubbed, inserted some distance behind the posterior clypeal margin (a distance usually greater than the basal width of the scape). Eyes well developed, often strongly protuberant, situated on the posterior half of the head. Anterolateral pronotal angles projecting as teeth or spines. Alitrunk most often marginate laterally; the propodeum usually bispinose or bidentate (very rarely otherwise). Petiole armed with from two to six teeth or spines. Acidopore concealed by the pygidium when not in use.

Arboreal, usually nesting in the wood or in rot holes in the trunk or branches. Some species build nests of silk mixed with vegetable fibres adherent to the undersides of leaves. A few species nest in the earth. Black, agile ants which may have strikingly coloured, dense pubescence (gold or silver) on the alitrunk or gaster.

Tribe FORMICINI

CATAGLYPHIS Förster

Cataglyphis Förster, 1850, *Verh. naturh. Ver. preuss. Rheinl.* **7** : 493. Type-species: *Formica megacola* Förster, 1850, op. cit. : 490. [= *Cataglyphis fairmairei* Förster, 1850, loc. cit.], by monotypy.

Mandibles strongly dentate; palp formula 6,4. Antennae 12-segmented, inserted very close to the posterior clypeal margin (a distance less than the basal width of the scape). Eyes and ocelli present, the eyes situated behind the midlength of the head. Petiole a node. Acidopore borne on a conical projection of the hypopygium and surrounded by a fringe of hair. Legs very long.

Large rust-red ants confined to savannah and semi-desert conditions; occurring on the coastal plains. Crater nests are made directly into the earth. The ants are very active and fast running.

Tribe LASIINI

PARATRECHINA Motschulsky

Paratrechina Motschulsky, 1863, *Bull. Soc. Nat. Moscou* **36** (3) : 13. Type-species: *Paratrechina currens* Motschulsky, 1863, op. cit. : 14 [= *Formica longicornis* Latreille, 1802, *Fourmis* : 113], by designation of Wheeler, 1911.

Mandibles narrow, armed with five or six teeth, weakly or not at all overhung by the clypeus. Anterior clypeal margin entire or weakly emarginate medially. Palp formula 6,4. Antennae 12-segmented, inserted close to the posterior margin of the clypeus. Eyes well developed, set at or in front of the midlength of the head. Ocelli absent. Propodeum unarmed; petiole a reduced scale, inclined forwards and often overhung by the first gastral segment; always unarmed above. Acidopore borne on a conical projection of the hypopygium, surrounded by a fringe of hairs. Dorsal surface of head, alitrunk and gaster with distinctly paired, coarse setae.

Nests usually in soil or compressed leaf-litter, less frequently in rotten wood or twigs.

PRENOLEPIS Mayr

Prenolepis Mayr, 1861, *Europ. Formicid.* : 35. Wien. Type-species: *Tapinoma nitens* Mayr, 1852, *Verh. zool.-bot. Ver. Wien* **2** : 144, by designation of Bingham, 1903.

As *Paratrechina* above but the eyes are behind the midlength of the head. The dorsal surfaces of the head, alitrunk and gaster usually have setae but these are never distinctly arranged in pairs and are usually fine.

PSEUDOLASIUS Emery

Pseudolasius Emery, 1877, *Ann. Mus. civ. Stor. nat. Giacoma Doria* **24** : 244. Type-species: *Formica familiaris* F. Smith, 1860, *J. Proc. Linn. Soc.* **5** : 68, by designation of Bingham, 1903.

Polymorphic. Mandibles usually with five or six, rarely with seven or eight teeth, set upon an oblique apical border. Palp formula 3,4 in largest workers, 3,3 in smallest. Clypeus well developed, overhanging the mandibles. Antennae 12-segmented, their insertions virtually confluent with the posterior clypeal margin. Major workers with small eyes present, situated at or just in front of the midlength of the head and on the dorsal surface. Minor workers without eyes. Petiole a scale which may be inclined forwards. Acidopore borne on a conical projection of the hypopygium and surrounded by a fringe of hairs.

Depigmented, yellowish coloured ants nesting in or under very rotten wood in or the soil amongst the roots of trees where dead wood is present. The workers actively avoid light but may be found on the surface of the ground during the night. Workers are often found in Berlese funnel samples of leaf-litter or log-mould.

Tribe **MYRMELACHISTINI**

APHOMOMYRMEX Emery

Aphomomyrmex Emery, 1899, *Annls Soc. ent. Belg.* **43** : 493. Type-species: *Aphomomyrmex afer* Emery, 1899, op. cit. : 494, by designation of Wheeler, 1911.

Polymorphic. Mandibles with three teeth. Antennae 9-segmented, without a differentiated club. Eyes well developed, oval, situated on the dorsal surface of the head at about the midlength. Ocelli present. Pro- and mesonotum in profile strongly convex. Scale of petiole high and narrow, emarginate dorsally.

Arboreal. Small (3·0–3·5 mm) black ants with the legs and antennae paler, reddish. Sides of alitrunk smooth and shining, dorsal surfaces of head, alitrunk and gaster finely punctate.

Tribe **OECOPHYLLINI**

OECOPHYLLA F. Smith

Oecophylla F. Smith, 1860, *J. Proc. Linn. Soc.* **5** : 101. Type-species: *Formica smaragdina* Fabricius, 1775, *Syst. Ent.* : 828, by monotypy.

Dimorphic. Mandibles elongate triangular, apical teeth long, acute and crossing over at rest. Apical margin behind the first tooth with seven to ten smaller teeth or denticles, of which the first and third are usually the largest. (This may not be true of minor workers.) Palp formula 5,4. Clypeus large, convex. its anterior margin overhanging the basal borders of the mandibles. Antennae 12-segmented, the first funicular segment longer than the second and third together. Eyes well developed, ocelli absent but shallow pits may mark their location in the major workers. Alitrunk strongly constricted in the mesonotal region, the pronotum and propodeum considerably broader than the region separating them. Petiole elongate and narrow in dorsal view, forming a low, rounded node in profile. Gaster with acidopore visible, not hidden by the pygidium.

Arboreal ants, making nests by binding leaves together with larval silk. The major workers are general carnivores and scavengers, the minors are rarely seen away from the nest. The single West African species *O. longinoda* (Latreille) tends large coccids, often building protective silk tents over large aggregations of coccids. The construction of the petiole allows reflexion of the gaster over the alitrunk, a position which the ants take when disturbed.

Tribe **PLAGIOLEPIDINI**

ACANTHOLEPIS Mayr

Acantholepis Mayr, 1861, *Europ. Formicid.* : 42. Wien. Type-species: *Hypoclinea frauenfeldi* Mayr, 1855, *Verh. zool.-bot. Ges. Wien* **5** : 378, by monotypy.

Mandibles with apical margin oblique, dentate, overhung by the clypeus. Palp formula 6,4. Antennae 11-segmented. Eyes well developed, ocelli present but may be reduced. Alitrunk constricted in the mesonotal region, the propodeum swollen and bidentate or bituberculate. Petiole a scale with the dorsal margin bispinose, bidentate or emarginate. Acidopore borne on a conical projection of the hypopygium, surrounded by a fringe of hairs.

Medium sized to small ants, usually black in colour but some species brown or yellowish. Nests are made in rotten wood either in standing trees or on the ground, or are built directly into hard-packed earth. The foragers of the larger species often ascend trees to tend aphids or coccids whilst those of other species are found only in the leaf-litter layer.

ACROPYGA Roger

Acropyga Roger, 1862, *Berl. ent. Z.* **6** : 242. Type-species *Acropyga acutiventris* Roger, 1862, op. cit. : 243, by monotypy.

Mandibles narrowly triangular, with five teeth, not overhung by the clypeus. Palp formula 2,3 (Wheeler, 1922) or 1,3 (Gotwald, 1969). Antennae 11-segmented. Eyes small, situated in front of the midlength of the side of the head; ocelli absent. Alitrunk not constricted in the mesonotal region. Propodeum unarmed; petiole an unarmed scale. Acidopore borne on a conical projection of the hypopygium surrounded by a fringe of hairs.

Small, depigmented, yellowish ants. Hypogaeic, uncommon.

PLAGIOLEPIS Mayr

Plagiolepis Mayr, 1861, *Europ. Formicid.* : 52. Wien. Type-species: *Formica pygmaea* Latreille, [1798], *Essai . . . Fourmis de la France:* 45. Brive, by monotypy.

Mandibles with five teeth; clypeus large and projecting over the basal borders of the mandibles. Palp formula 6,4. Antennae 11-segmented. Eyes well developed, situated in the middle of the sides of the head; ocelli usually absent but may be present. Alitrunk short, weakly constricted between the pronotum and propodeum. Propodeum unarmed; petiole a reduced scale, inclined forwards and may be overhung by the first gastral segment, but never armed or emarginate. Acidopore borne on a conical projection, surrounded by a fringe of hairs.

Medium to small ants, monomorphic or polymorphic. Nests are made under the bark of trees, in rotten wood or twigs, or in hard-packed earth.

Tribe SANTSCHIELLINI

SANTSCHIELLA Forel

Santschiella Forel, 1916, *Revue Suisse Zool.* **24** : 434. Type-species: *Santschiella kohli* Forel, 1916, op. cit. : 435, by monotypy.

Mandibles with seven or eight teeth. Antennae 12-segmented. Eyes very large, occupying almost the whole of the side of the head; ocelli present. Head bordered posteroventrally by a transparent ridge which ends abruptly and is followed by a tooth. Propodeum bispinose. Node of petiole truncated posteriorly, armed posterodorsally by an obtuse tooth on each side.

Rare, believed to be arboreal.

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B. K. TANDAN

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By B. K. TANDAN

CONTENTS

SYNOPSIS

This part of a series of papers on *Myrsidea* Waterston deals with the species parasitic on babblers of the genera *Garrulax* and *Pomatorhinus* (subfamily Timaliinae, Aves). It includes a redescription of one known and descriptions of 12 new species, a key to the species, a host-parasite list and a short discussion on host-parasite relationships.

INTRODUCTION

This is part VII in the series of papers initiated by Clay (1966). Like the previous part (Tandan & Clay, 1971) this too is devoted to species of *Myrsidea* parasitic on babblers (subfamily Timaliinae of Muscicapidae) and deals with species parasitizing the genera *Garrulax* and *Pomatorhinus*. Although this part was intended exclusively for species parasitizing *Garrulax*, species from *Pomatorhinus* have been included as they were found to resemble closely those occurring on certain species of *Garrulax*. The host-names are according to Deignan in the *Check-List of Birds of the World* (1964), and the names of Provinces of Thailand are also as given in Deignan (1963). The following abbreviations have been used for the collections which are the depositories for the material on which this study is based: BMNH, British Museum (Natural History); USNM, U.S. National Museum; EC, K.C. Emerson collection; REC, Robert E. Elbel collection.

TAXONOMIC CHARACTERS

The characters common to all or most of the species dealt with in this paper are given below. Neither these characters nor the generic characters given by Clay (1966 : 330–332 and 1969) are repeated in the specific descriptions.

1. *Head* of the same general shape (Pl. 1, figs 55–57), differences shown by measurements. Head chaetotaxy basically as in *M. thoracica* (see Clay, 1966, fig. 1), as also the relative proportions of the pair of setae on the last segment of the maxillary palp but in some taxa there may be greater individual variation. End of seta 10 usually reaches to about the middle of seta 11 (Text-fig. 10). Gular setae usually 4 + 4, occasionally 4 + 3 or 4 + 5 and exceptionally 3 + 3, 5 + 5 or 6 + 5. Antenna as in Clay, 1966, fig. 2, and the two sensilla coeloconica (Clay, 1969 : 8, 1970 : 76) on the second segment slightly apart. Hypopharynx variable.

2. *Thorax.* Pronotum with 3 + 3 setae near each antero-lateral corner of which, according to available evidence, the 2 + 2 outer spiniform ones may be propleural setae and the relatively 1 + 1 inner moderately long to long pronotal setae. Posterior margin of pronotum with 3 + 3 long and stout setae. Mesonotum undivided. Metanotum normal or modified with 3 + 3 antero-lateral spiniform and 1 + 1 long postero-lateral setae (not included in setal counts), lying between the latter are a variable number of marginal setae. Metapleural setae spiniform. Metasternal plate triangular in shape with a varying number of setae, its anterior width depending on that of the metanotum but the posterior narrow apex variable in length. One or two of the metasternal setae each side are anterior and more central than the remaining somewhat marginal ones; only in one species was the number of anterior setae over 4 (Text-figs 14, 15). First tibia with 3 + 3 outer ventro-lateral and a varying number of dorso-lateral setae.

3. *Abdomen.* In both sexes spiracles open on the tergites; in the female either IV or V, in the male V, is the broadest tergite. In the female the anterior terga are normal or modified, the extent of modification being reflected by the curvature of the line of marginal setae; the edge of the vulva may be smooth or serrated. Microtrichia of the inner surface of the genital chamber variable in the three species in which they are visible. No structure resembling the complicated bursa copulatrix of forms infesting *Turdoides* (Timaliinae) and Icteridae (Clay, 1968; Tandan & Clay, 1971) surrounds the opening of the spermathecal duct in the genital chamber. The duct either appears to open in a depression at the apex of a papilla (Text-fig. 37), the genital papilla (sensu Kéler, 1971 : 10), with the opening being usually visible, or in a thin-walled sac, without the opening being visible. While the genital papilla may or may not have characteristic pigmentation, the duct proximal to the opening is usually wider and appears to be somewhat hardened. On the other hand, the structurally simpler, thin-walled sac is probably the homologue of the bursa copulatrix as indicated by the presence of concretions in the sac of one species (*orientalis*) resembling those seen inside the bursa of diverse species parasitic on *Turdoides*. Owing to the membranous nature of the duct and sac (or bursa copulatrix), they are not always apparent in all specimens, so that in those species (*patkaiensis* and *macraidoia*) in which one or both these structures have not been seen, they may in fact be present. However, the details of these structures differ in different individuals of the same species (Text-figs 33, 34), due mainly to distortion produced during preparation of the specimen, and as the number of specimens is small, these limitations prevent a satisfactory comparison between populations from different hosts.

The male genitalia have all the basic components composing the external genitalia

of *Myrsidea*. These show more specific variation than has been found in recent studies of groups of species from related hosts, in which it is usually only the genital sclerite which shows specific differences. A long and narrow spermatophore closely associated with the genital sclerite has been seen in some species.

Abdominal chaetotaxy. Tergites without anterior setae. Post-spiracular setae III and V always shorter and finer than II and IV, III being slightly longer than V. In the male on tergum IX 1 + 1 (occasionally 3) moderately long to long marginal and 4 + 4, exceptionally 9 or 10, short internal anal setae. Anterior setae absent or present on pleurites II–VII, or some of them. Pleurite VIII has 3 + 3 setae, the central one being very long and stout, but the lengths of the outer and inner ones relative to each other vary; extra inner setae (v) are usually present in the female, rarely in the male (Text-fig. 27). Sternite I without setae. Arrangement of setae on sternites IV–VII in the female, IV–VIII in the male and the genital region in both sexes as in *Myrsidea* from *Trudoides* (see Tandan & Clay, 1971), only the setae in the genital region being much stouter. The outermost setae on the vulval margin stouter than the inner ones.

The following abdominal setae are found in all the species dealt with here: 1 + 1 antero-lateral, spiniform on tergite I; 1 + 1 post-spiraculars on I–VIII and the associated spiniform of the post-spiracular setal complex (Clay, 1970) on II–VIII; in the male usually 1 + 1, occasionally 1 + 2, moderately long to long on posterior margin of IX; 2 + 2 antero-lateral, spiniform or short on sternite II; 1 + 1 postero-lateral on sternite VIII in the male and 2 + 2 in the genital region of both sexes; 3 + 3 laterals on segment IX, the 2 + 2 outer and relatively dorsal ones being probably pleural. These setae have been excluded from the setal counts given in the text, Key and Tables, with the exception of the 1 + 1 postero-lateral setae on sternite VIII in the male and 2 + 2 in the genital region, which may not be readily identifiable when there are numerous setae in this part. The 2 + 2 setae on sternite II, usually separable from other setae by their proportions and antero-lateral position, may not always be separable on one or both sides when the number of setae on this sternite is greater (Text-fig. 29).

A combination of some of the following taxonomic specific characters has been found useful in determining the status of populations from different hosts, the relatively more important ones having been marked with an asterisk (*). 1. Degree of development of hypopharynx*. 2. Form of anterior terga and nature of the vulval margin in the female*. 3. Form of metanotum in the female and shape of metasternal plate. 4. Shape of components of male genitalia, especially the genital sclerite*. 5. Details of the structure associated with the opening of the spermathecal duct*. 6. Number of dorso-lateral setae on tibia I and in the brush on femur III. 7. Number of setae on metanotum and metasternum. 8. Length of setae on pleurite I in the female; presence or absence of anterior setae on pleurites II–VII and the relative proportions of the outer and inner setae on pleurite VIII. 9. Number of setae on tergum IX in the female, on I and of terminal setae on IX in the male. 10. Number and length of setae on tergum I in the female and on VIII in both sexes*. 11. Length of post-spiracular setae III, V and VI. 12. Number of setae on sternite II in both sexes and also III in the female*. 13. Arrangement

of setae on sternites II and III in the female*. 14. Presence or absence of central anterior setae on sternites III or IV–VI. 15. Number of setae in the genital region and on vulval margin*.

SPECIES DESCRIPTIONS

The following species-descriptions and measurements (in millimetres, usually corrected to two decimal places) are on the same lines as those given by Clay (1966, 1968) and the Tables of the sternal chaetotaxy, based on specimens from the type-host only, by Tandan & Clay (1971). Figures in parentheses denote the number of specimens or structures examined or measured, and x̄ the mean. The chaetotaxy in the figures agrees with the specimens from which these were drawn and broken or missing setae, shown by broken lines, have been usually completed from the other side of the same specimen or from another specimen.

Myrsidea sehri Ansari, 1951

(Pl. 2, fig. 59; Text-figs 10, 21, 39)

Type-host: *Garrulax l. lineatus* (Vigors).

Myrsidea sehri Ansari, 1951 : 177, fig. 19. Holotype ♀, from *Trochalopteron lineatum grisescentior* (Hartert), INDIA (BMNH) [examined].

Only the two specimens comprising the type-material of this species, the first *Myrsidea* to be described from one of the Timaliinae, have been available for study. These are in poor condition with most of the thoracic and abdominal setae missing and it has not been possible to take all the necessary measurements or to determine the size of the taxonomically important setae—post-spiracular, those on tergum VIII and in the female on tergum I. In the male genitalia the parameres are twisted giving the impression of being 'exceptionally reduced' as interpreted by Ansari (1951 : 178), but fortunately the genital sclerite is undamaged. While the genital sclerite distinguishes the male allotype from other species, satisfactory separation of the female holotype, especially from *erythrocephali*, could not be made and must await a good series from the type-host.

♀ and ♂. Hypopharynx considerably reduced. In the female, tergum I unmodified, vulval margin well to strongly serrated along the greater part of its width, microtrichia of genital chamber as in *M. abidae* (see Clay, 1966: fig. 24), but more closely set and slightly longer, and internally a distinctive crown-like sclerite, probably associated with the spermathecal duct (Text-fig. 39). Male genital sclerite distinctive (Pl. 2, fig. 59), apparently no posterior pointed processes. Metasternal plate normal (Text-fig. 21). Metanotal setae: ♀ and ♂, probably 2 + 2. Metapleural setae: ♀, 4 + 3; ♂ probably 2 + 2. Metasternal setae: ♀ and ♂, 3 + 3. Outer dorsal setae of tibia I: ♀ and ♂, 4 + 3. Setae of femoral brush: ♀, 23 + 23 (not 21 as given in the original description); ♂, both femora missing.

ABDOMINAL CHAETOTAXY. Tergal setae: ♀, I, 2 + 2; II, 4 + 6; III, 5 + 6; IV–VI, 7 + 7; VII, 6 + 6; VIII, 4 + ? (three alveoli are visible on this side which has a damaged lateral edge); IX, 2 long. ♂, I, 2 + 2; II, 4 + 4; III, 5 + 5; IV, 6 + 7; V, 7 + 6; VI, 6 + 6; VII, 5 + 5; VIII, 3 + 3; IX, terminal 4. In both sexes, judging from their alveoli, the 2 central setae on

tergum I are probably long; the length of those on VIII is not determinable. Pleural setae: anterior setae absent. VIII: ♀ with an extra inner seta on one side; in both sexes inner and outer setae moderately long and equal in length. Sternal setae. ♀. II, probably 8 anterior, all central; 15 marginal; aster 4 + 4; III, anterior absent, 21 marginal; IV, 6 anterior, 28 marginal; V, 7, 26; VI, 8, 23; VII, 12, 12. The marginal setae in both sexes include those of the lateral brushes on III–VII. Anterior setae in lateral brushes: III, 3 + 2; IV, 7 + 10; V, 14 + 14; VI, 11 + 10; VII, 5 + 6. Genital region 6 + 6; vulval marginal 9 (4 + 4 lateral, 1 central). ♂. II, 7 anterior, marginal 13; aster 4 + 3; III, anterior absent, 18 marginal; IV, 3 anterior, 22 marginal; V, VI, 7, 24; VII, 6, 11; VIII, ?. Anterior setae in lateral brushes: III, 0 + 1; IV, 7 + 7; V, VI, 14 + 10; VII, 4 + 3. Genital region, probably 6 or 7 + 5.

Four species, *erythrocephali* (both sexes), *thailandensis* (male not available), *sikkimensis* (female not available) and *singularis* (male only), which like *sehri* have the reduced hypopharynx and lack anterior setae on the pleurites, all have setae on tergum VIII of which the ends do not cross the margin of tergum IX. It can therefore perhaps be presumed (see also discussion under *singularis*, page 385) that the missing setae on tergum VIII of *sehri* are of a length similar to those of these species; this has been assumed for the purposes of the key.

MEASUREMENTS of ♀ holotype and ♂ allotype. *Length*: head, ♀ 0·315; ♂ 0·29. *Breadth*: preocular, ♀ 0·34; ♂ 0·31. Temples, ♀ 0·50; ♂ 0·435. Pronotum, ♀ 0·31; ♂ 0.28. Metanotum, ♀ 0·465; ♂ 0·35. Broadest tergite: ♂ 0·54. Length of post-spiracular setae. ♂, V, 0·128, 0·141.

MATERIAL EXAMINED.

Holotype ♀, allotype ♂ of *Myrsidea sehri* Ansari, 1951 from *Trochalopteron lineatum grisescentior* = *Garrulax l. lineatus* (Vigors), INDIA: Kulu, Panjab, 6.x.1939 (BMNH).

Myrsidea erythrocephali sp. n.

(Pl. 2, fig. 60; Text-figs 1, 2, 33, 34, 43)

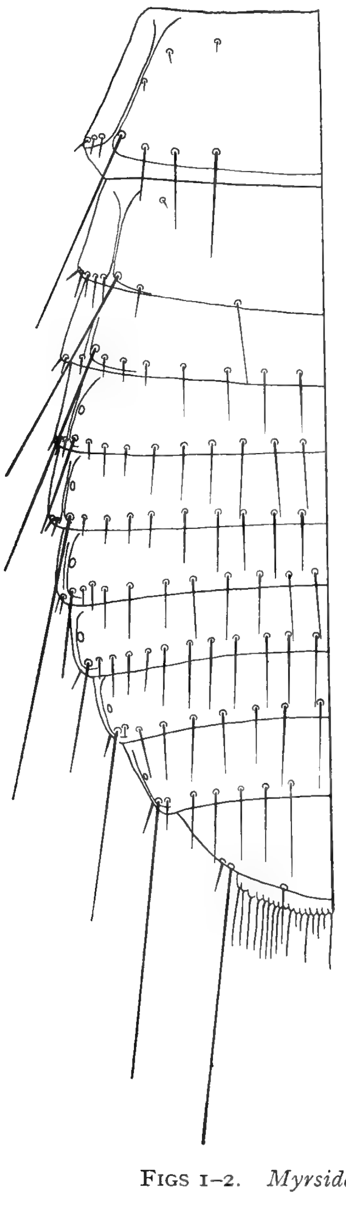
Type-host: *Garrulax erythrocephalus* (Vigors).

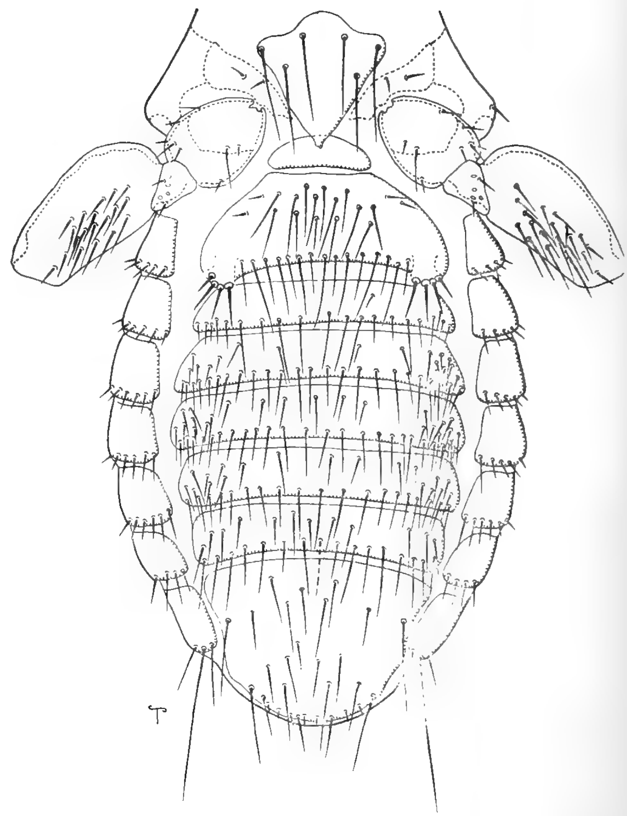
This species closely resembles the following two species, *manipurensis* and *duplicata*, being distinguished from them in both sexes by the greatly reduced hypopharynx. Further characters separating the female from that of *manipurensis* are the relative proportions of the two central and two lateral setae on tergum I, and from that of *duplicata* the greater enlargement of tergum I and the details of the chaetotaxy. No characters other than the hypopharynx and the details of the chaetotaxy have been found for separating the male from that of *duplicata*; these characters together with the proportions of the inwardly directed arm of the basal apodeme and the shorter post-spiracular setae V and VI separate the male from that of *manipurensis*.

♀ and ♂. Hypopharynx greatly reduced. In the female, tergum I moderately enlarged and II very slightly modified; vulval margin well serrated medially, smooth at the extreme lateral ends. Spermathecal duct and genital papilla as in Text-figs 33, 34; in 33 the duct is probably compressed, hence the squat shape. In the male genitalia (Text-fig. 43) the parameres are slightly curved and anteriorly narrow, and the inwardly directed arm of the basal apodeme is prominent and tapers posteriorly; genital sclerites (Pl. 2, fig. 60) as in *manipurensis* and *duplicata*. Apex of metasternal plate not produced (Text-fig. 2). Metanotal setae: ♀ 6–8 (7); ♂ 4–5 (8).

Metapleural setae: ♀ 3–4, x̄ 3·19 (16 sides); ♂ 2–3, x̄ 2·12 (16). Metasternal setae: ♀ (8) and ♂ (8), 3 + 3. Outer dorsal setae of tibia I: ♀ (16 tibiae), ♂ (14), 4. Setae of femoral brush: ♀ 18–24, x̄ 19·21 (14 femora); ♂ 16–20, x̄ 18 (16).

ABDOMINAL CHAETOTAXY. Tergal setae: ♀ (Text-fig. 1); I, 2 + 2 (7), the 2 central setae long and longer than the 2 lateral short to moderately long ones; II, 12–15, x̄ 12·80 (5); III, 14—17, x̄ 15·57 (7); IV, 15–19, x̄ 16·85 (7); V, 16–23, x̄ 19·30 (7); VI, 16–20, x̄ 18·33 (6); VII, 15–18, x̄ 17 (6); total of II–VII, 97–106, x̄ 102 (3); VIII, 7–11, x̄ 9·16 (6); IX, 2 (7) moderately long. ♂; I, 2 + 2 (8); II, 7–12, x̄ 10·66 (6); III, 10–14, x̄ 12·33 (6); IV, 12–16, x̄ 14·66 (6); V, 13–17,





FIGS 1–2. *Myrsidea erythrocephali.* 1 (left), ♀ dorsal; 2, ♂ ventral.

$\bar{x}$ 15·16 (6); VI, 12–17, $\bar{x}$ 14·50 (6); VII, 11–14, $\bar{x}$ 12·33 (6); total of II–VII, 65–86, $\bar{x}$ 79·66 (6); VIII, 6–8, $\bar{x}$ 6·71 (7); IX, terminal 4 (7). In both sexes the ends of the more central setae on tergum VIII fall well short of the posterior margin of tergum IX. Pleural setae: anterior setae absent. VIII: ♀ usually with an extra inner seta on one or both sides; in both sexes outer and inner setae as in Text-fig. 2. Sternal setae. ♀: II, anterior 10–12 (8), all central; marginal 11–14, $\bar{x}$ 12·57 (7); total of anterior and marginal 21–25, $\bar{x}$ 23·57 (7); aster 4–5, $\bar{x}$ 4·53 (15 asters); III—VII, Tables I, IV; total number on VII, 27–34, $\bar{x}$ 30·20 (5); genital region 10–14, $\bar{x}$ 11 (7); vulval marginal, each side 4–6, total 9–11 (7), those of the two sides separated by a wide gap. ♂ (Text-fig. 2): II, anterior 10–14, $\bar{x}$ 12·30 (7); marginal 12–15, $\bar{x}$ 13·75 (8); total of anterior and marginal 22–29, $\bar{x}$ 26 (7); aster 4–5, $\bar{x}$ 4·06 (16); III–VII or VIII, Tables II, VI; total number on VII, 20–28, $\bar{x}$ 25 (5); genital region 13–16, $\bar{x}$ 14·25 (8).

MEASUREMENTS. *Length*: total, ♀ 1·66–1·80, $\bar{x}$ 1·72 (5); ♂ 1·35–1·49, $\bar{x}$ 1·44 (6). Head, ♀ 0·30–0·32, $\bar{x}$ 0·31 (6); ♂ 0·29–0·30, $\bar{x}$ 0·294 (6). *Breadth*: preocular, ♀ 0·33–0·35, $\bar{x}$ 0·34 (6); ♂ 0·31–0·32, $\bar{x}$ 0·313 (6). Temples, ♀ 0·48–0·50, $\bar{x}$ 0·485 (6); ♂ 0·42–0·45, $\bar{x}$ 0·44 (6). Pronotum, ♀ 0·29–0·32, $\bar{x}$ 0·31 (6); ♂ 0·265–0·29, $\bar{x}$ 0·28 (6). Metanotum, ♀ 0·435–0·48, $\bar{x}$ 0·45 (6); ♂ 0·35–0·38, $\bar{x}$ 0·37 (6). Broadest tergite: ♀ 0·61–0·70, $\bar{x}$ 0·65 (5); ♂ 0·52–0·53, $\bar{x}$ 0·523 (6). Length of post-spiracular setae: ♀ (10), III 0·128—0·168, $\bar{x}$ 0·143; V 0·104–0·124, $\bar{x}$ 0·115; VI 0·153–0·198, $\bar{x}$ 0·189. ♂ (10), III 0·111–0·131, $\bar{x}$ 0·122; V 0·094–0·118, $\bar{x}$ 0·106; VI 0·128–0·205, $\bar{x}$ 0·158.

MATERIAL EXAMINED.

Holotype ♂, slide no. SE-1861, from *Garrulax erythrocephalus* (Vigors), THAILAND: Doi Inthanon, Chiang Mai Province, 28.xi.1964 (*H. E. McClure*) (USNM).

Paratypes. From *G. erythrocephalus*, THAILAND : 4 ♂, Chiang Mai Province, Doi Inthanon, 26–28.xi.1964 (*H. E. McClure*); 8 ♀, 3 ♂, Doi Pha Hom Pok, 30.x., 31.x., 11.xi.1965; 1 ♀, Chom Thong, 4.ii.1971 (*K. Thonglongya*) (EC).

A male and female, slide no. MAPS 2283, from *Pomatorhinus erythrogenys* Vigors (THAILAND: Doi Pha Hom Pok, Chiang Mai Province, 11.xi.1965 (EC)) show characters somewhat intermediate between *erythrocephali* and *duplicata*, the male genital sclerite being the same as in these species and also *manipurensis*, while the other components of the genitalia and the genital papilla are as in *erythrocephali*. Further specimens must be examined from this host before it is possible to decide whether the population merits an independent taxonomic status or whether it can be included in *erythrocephali* s. l.

Myrsidea manipurensis sp. n.

(Pl. 1, fig. 55; Text-figs 3, 13, 35, 48)

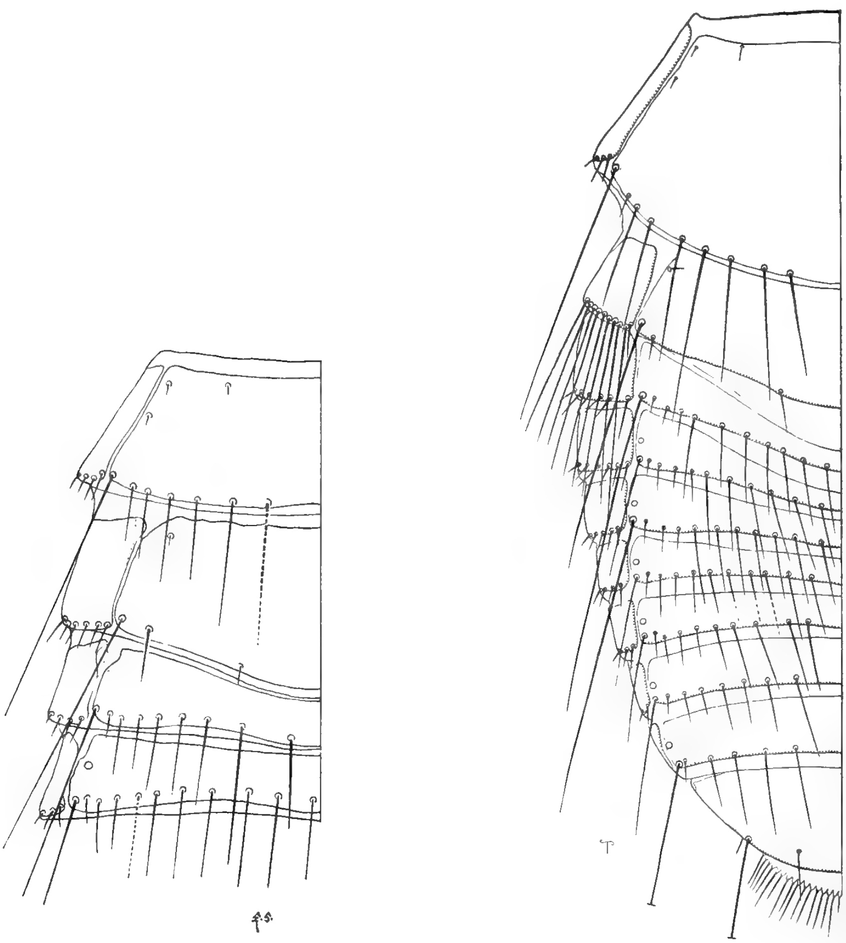
Type-host: *Garrulax squamatus* (Gould).

Characters distinguishing this species from *erythrocephali* and *duplicata* are given under those species and the characters in which this form resembles *erythrocephali* are not repeated here.

♀ and ♂. Hypopharynx fully developed. In the female tergum I considerably enlarged and II slightly modified; vulval margin with median serrated portion somewhat narrower than in *erythrocephali*; genital papilla, on which the spermathecal duct opens, distinctive (Text-fig. 35). Male genitalia similar to those of *erythrocephali*, but the inwardly projecting dorsal arm of the basal apodeme is significantly shorter, the parameres are slightly more curved (Text-fig. 48) and the genital sclerite is somewhat smaller. Apex of metasternal plate very slightly produced

(Text-fig. 13). Metanotal setae: ♀ (2) 10, 11; ♂ 4–5 (6). Metapleural setae: ♀ 3–4, $\bar{x}$ 3·50 (4 sides); ♂ 2 (8). Outer dorsal setae of tibia I: ♂ 3–4, $\bar{x}$ 3·87 (8 tibiae). Setae of femoral brush: ♀ 15–18, $\bar{x}$ 16·25 (4 femora); ♂ 15–17, $\bar{x}$ 15·87 (8).

Abdominal Chaetotaxy. Tergal setae: ♀ (2, holotype given first followed by that of the paratype if different) (Text-fig. 3); I, 2 + 2, the 2 central setae fine and short to moderately long and the 2 long outer ones considerably longer and stouter; II, 15, 14; III, 16, 17; IV, 20, 17; V, 23, 21; VI 18, 23; VII, 20, 18; total of II–VII, 112, 110; VIII, 12, 11; IX, 2 long. ♂ (4); I, 2 + 2; II, 10–13, $\bar{x}$ 11·75; III, 12–14, $\bar{x}$ 13; IV, 12–15, $\bar{x}$ 13·25; V, 13–15, $\bar{x}$ 14·25; VI, 13–16, $\bar{x}$ 15·50; VII, 13–14, $\bar{x}$ 13·25; total of II–VII, 75–88, $\bar{x}$ 81; VIII, 6–9, $\bar{x}$ 7·25; IX, terminal 4. The ends of the more central setae on tergum VIII fall short of the posterior margin of tergum IX but may just cross it in the male. Pleural setae of VIII: ♀, 1 + 1 extra inner setae (2). Sternal setae. ♀ (2): I, 1; II, anterior 13, 14, all central; marginal 7; aster 5–6, $\bar{x}$ 5·50 (4 asters); total number on VII, 33, 41; genital region 12, 13; vulval marginal, each side 3–4, total 6–8. ♂ (4): II, anterior 14–18, $\bar{x}$ 15·75; marginal 11; aster, $\bar{x}$ 4·12 (8); total number on VII, 22–26,



Figs 3–4. *Myrsidea* spp., ♀, holotype, dorsal. 3 (left), *M. manipurensis*; 4, *M. singularis*.

$\bar{x}$ 23·50; genital region 14–16. Compared to *erythrocephali* setae in the femoral brush tend to be fewer and metanotal setae and setae on terga II–VIII tend to be slightly more in number. The female tends to have fewer marginal setae on sternite II, setae in lateral brushes on sternites III–VI (Table IV) and on the vulval margin, but tends to have more setae on sternite VII. The male tends to have more central anterior setae on sternite II and fewer central setae on sternites III–V and slightly less dense brushes of setae on sternites IV–VI (Tables II, VI).

MEASUREMENTS of 2 ♀ (holotype given first, followed by paratype if different) and 4 ♂. *Length* total, ♀ 1·83, 1·64; ♂ 1·44–1·49, $\bar{x}$ 1·46. Head, ♀ 0·32; ♂ 0·29–0·31, $\bar{x}$ 0·30. *Breadth*: preocular, ♀ 0·37; ♂ 0·33–0·34, $\bar{x}$ 0·337. Temples, ♀ 0·53, 0·50; ♂ 0·47–0·48, $\bar{x}$ 0·474. Pronotum, ♀ 0·33, 0·32; ♂ 0·29–0·30, $\bar{x}$ 0·297. Metanotum, ♀ 0·52, 0·51; ♂ 0.377–0·389, $\bar{x}$ 0·381. Broadest tergite: ♀ 0·71, 0·73; ♂ 0·53–0·54, $\bar{x}$ 0·534. Length of post-spiracular setae: ♀, III 0·138, 0·160; V 0·138, 0·146; VI 0·205, 0·237. ♂, III 0·123–0·135, $\bar{x}$ 0·130 (7); V 0·106–0·133, $\bar{x}$ 0·123 (8); VI 0·202–0·242, $\bar{x}$ 0·223 (8). These, especially V and VI, tend to be longer than in *erythrocephali* and *duplicata*.

MATERIAL EXAMINED.

Holotype ♀, slide no. 19879*a*, from *Garrulax squamatus* (Gould), INDIA: Kangpokpi, Manipur, Assam State, 29.i.1952 (*R. Meinertzhagen*) (BMNH).

Paratypes. 1♀, 4♂, with data as given for holotype.

Myrsidea duplicata sp. n.

(Text-figs 36, 37)

Type-host: *Pomatorhinus schisticeps* Hodgson.

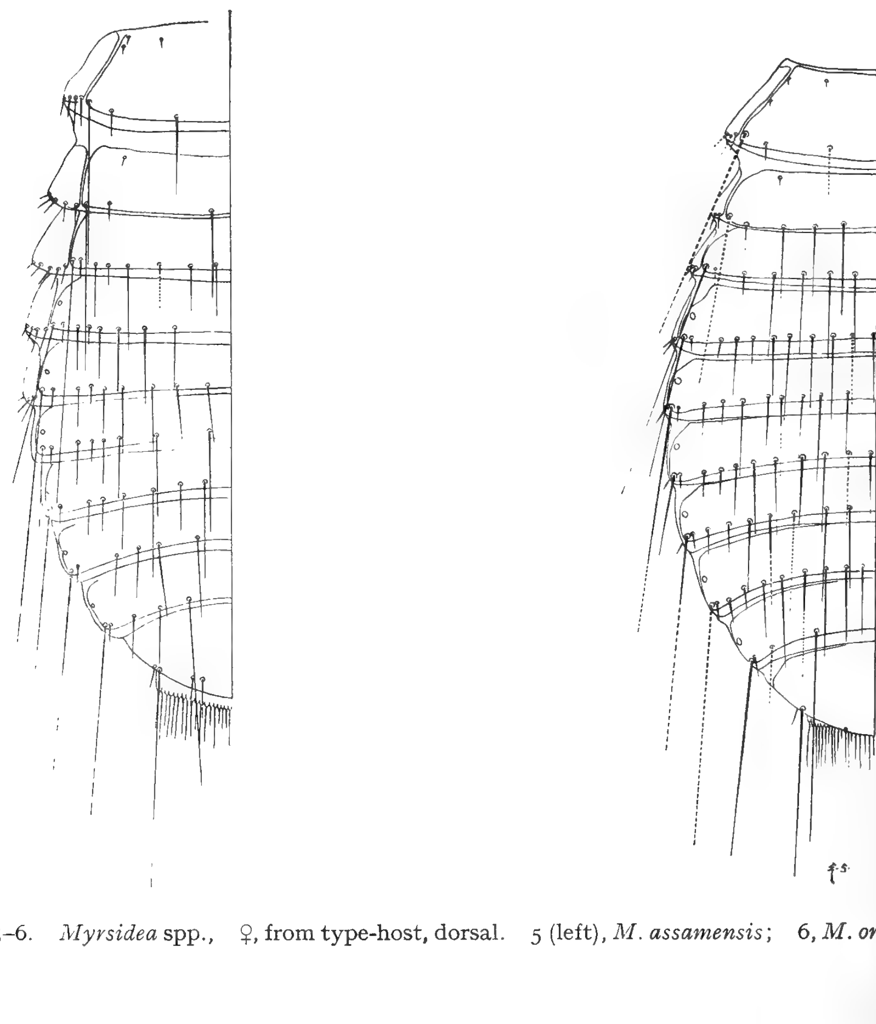
This species resembles most closely *erythrocephali* and *manipurensis*, especially the latter in the character of the fully developed hypopharynx. It is slightly smaller than *manipurensis* and distinguished in the female by the form of terga I and II and the relative proportions of the 2 central and 2 lateral setae on tergum I; but no character other than the proportions of the inwardly directed arm of the basal apodeme has been found for separating the two available males. Characters which separate it from *erythrocephali* are given under that species and those in which it resembles *manipurensis* (and *erythrocephali*) have been generally omitted from the description.

♀ and ♂. Hypopharynx fully developed. In the female tergum I very slightly but perceptibly enlarged and II normal. Serrations of vulval margin and the metasternal plate in both sexes as in *erythrocephali*. Genital papilla on which the spermathecal duct opens as in Text-figs 36, 37, the presence of a depression around the opening of the duct being suggested by the specimen shown in Text-fig. 37. Male genitalia mainly as in *erythrocephali*, the genital sclerite as in *erythrocephali* and *manipurensis* but in the available material appears to differ somewhat in proportions. Metanotal setae: ♀ 9–10 (4); ♂ (2) 5, 6. Metapleural setae: ♀ 2–3, $\bar{x}$ 2·75 (8 sides). Metasternal setae: ♀ 6–7 (4). Outer dorsal setae of tibia I: ♀ 3–5, $\bar{x}$ 4 (8 tibiae); ♂ 4 (3). Setae of femoral brush: ♀ 13–16, $\bar{x}$ 14·43 (7 femora); ♂ 13–15, $\bar{x}$ 14 (4); these tend to be fewer than in *manipurensis* and *erythrocephali*.

ABDOMINAL CHAETOTAXY. Tergal setae: ♀; I, 2 + 2 (1), 2 + 3 (3) due to an additional seta on one side only between the central and lateral tergal setae and of which the position is not constant; on I the 2 central setae long and longer than the moderately long outer setae (the latter are slightly longer than in *erythrocephali*); total of II–VII, 87, 90 (2); VIII, 8–9, $\bar{x}$ 8·66 (3); IX, 2 moderately long. ♂ (2); I, 2 + 2; total of II–VII, 69, 76; VIII, 6; IX, terminal 4, 5.

In the female both range and mean of the total number of setae on II–VII is less than in *manipurensis* and *erythrocephali*; in the male only the mean is less. Pleural setae of VIII: ♀, 1 + 1 extra inner setae (4). Sternal setae. Compared to *manipurensis* the female has fewer anterior setae on sternite II (anterior 6–8, all central, marginal 6–9, total of anterior and marginal 13–15 (4), markedly fewer central anterior setae and somewhat fewer setae in the lateral brushes on sternites IV–VII and in the genital region (9–11 (4)), but the vulval marginal setae (each side 4–6, total 8–11, $\bar{x}$ 9 (4)) tend to be slightly more. The male also has fewer anterior setae on sternites II (anterior 10, 11, marginal 9 (2)) and IV–VIII, due to their absence on IV and their smaller number on other sternites, as also in the genital region (5 + 5, 7 + 7). The asters also have fewer setae (♀ 3–4, $\bar{x}$ 3·62 (8 asters); ♂ 3 + 3 (2)).

Measurements of 4♀ and 2♂. *Length*: total, ♀ 1·51–1·61, $\bar{x}$ 1·58; ♂ 1·26, 1·38. Head, ♀ 0·30–0·31, $\bar{x}$ 0·306; ♂ 0·288, 0·30. *Breadth*: preocular, ♀ 0·32–0·34, $\bar{x}$ 0·33; ♂ 0·306, 0·312. Temples, ♀ 0·47–0·49, $\bar{x}$ 0·48; ♂ 0·43, 0·44. Pronotum, ♀ 0·30–0·31, $\bar{x}$ 0·306; ♂ 0·276, 0·282. Metanotum, ♀ 0·435–0·49, $\bar{x}$ 0·46; ♂ 0·347, 0·353. Broadest tergite: ♀, 0·63–0·70, $\bar{x}$ 0·65; ♂ 0·48. Length of post-spiracular setae: ♀, III 0·123–0·148, $\bar{x}$ 0·132 (8); V 0·123–0·143, $\bar{x}$ 0·134 (7); VI 0·188–0·222, $\bar{x}$ 0·207 (7). ♂, III 0·109–0·123, $\bar{x}$ 0·114 (3); V 0·111–0·123, $\bar{x}$ 0·114 (4); VI 0·173–0·202, $\bar{x}$ 0·184 (4).



Figs 5–6. *Myrsidea* spp., ♀, from type-host, dorsal. 5 (left), *M. assamensis*; 6, *M. orientalis*.

MATERIAL EXAMINED.

Holotype ♀, slide no. SE-1881*a*, from *Pomatorhinus schisticeps* Hodgson, THAILAND: Doi Pui, Chiang Mai Province, 11.ii.1965 (*H. E. McClure*) (USNM).

Paratypes 3♀, 2♂, with data as given for holotype (EC).

Specimens from *Pomatorhinus ferruginosus* resemble *duplicata* in the torm ot terga I and II, the relative proportions of the central and lateral setae on tergum I, the serrated portion of the vulval margin, the genital papilla and the opening of the spermathecal duct (Text-fig. 38), and the male genitalia with the exception of one component. The inwardly directed arm of the basal apodeme whilst intermediate between that of *duplicata* and *manipurensis* approximates that of the former species. The general chaetotaxy also agrees closely with that of *duplicata* but there are more sternal setae in both sexes; as in *manipurensis* there are central anterior setae on sternites IV and V in the male. However, as the series on which *duplicata* is based is small and the specimens from *P. ferruginosus* also few and not in good condition, their taxonomic position can be decided only after a comparative study of more specimens. The data of these specimens, which are excluded from the type-series of *duplicata*, are as follows:

From *Pomatorhinus ferruginosus* Blyth, THAILAND: Dai Pha Hom Pok, Chiang Mai Province, 2♀, 2♂, 28.x., 16.xi.1965 (EC).

Myrsidea thailandensis sp. n.

Type-host: *Garrulax merulinus* Blyth.

The combination of characters possessed by the single female from *G. merulinus* is striking and separates it readily from the females of all other species dealt with here. It is distinguished from *manipurensis* by the reduced hypopharynx, and from all those in which the hypopharynx is reduced either by the number (2 + 2) of setae on tergum I alone or in combination with the relative proportions of the two central and two lateral setae on this tergum. The characters of the female indicate it to be closest to *erythrocephali*, *manipurensis* and *duplicata*, but in the absence of the male, of which the genital sclerite is usually a more reliable guide to relationships, the precise position of this species is indeterminable.

♀. Hypopharynx considerably reduced; tergum I considerably enlarged, II slightly modified; metasternal plate and vulval margin similar to those of *erythrocephali*. Details of genital papilla are not clear due to distortion, but it seems to be either as in *duplicata* or *erythrocephali*. Metanotal setae 8; metapleural setae 3 + 4; metasternal setae 3 + 3; outer dorsal setae of tibia I 4 + 5; setae of femoral brush 18 + 19.

ABDOMINAL CHAETOTAXY. Tergal setae: I, 2 + 2 as in *manipurensis* (Text-fig. 3) but the lateral setae are slightly shorter; II–VII, total 104; VIII, 11, the tips of the more central ones falling short of the posterior margin of tergum IX; IX, 2 moderately long. Pleural setae: anterior setae absent. VIII, 2 + 1 extra inner setae (that on left-hand side resembling the adjoining inner seta), the inner and outer setae as in *erythrocephali*. Sternal setae. II, anterior 9, all central (smaller number than in *manipurensis*); marginal 7; aster 6 + 5 (as in *manipurensis*); genital region 7 + 5; vulval marginal 4 + 5. The number of setae on sternites III–V approximately as in *manipurensis* but differs slightly on VI and VII: central anterior and marginal setae respectively on VI, 11 and 12, on VII, 10 and 12. Anterior setae in lateral brushes on IV–VII also slightly more than in *manipurensis*.

MEASUREMENTS of the ♀ holotype. *Length*: total 1·72; head 0·29. *Breadth*: preocular 0·33; temples 0·49; pronotum 0·29; metanotum 0·50; tergite V, 0·65. Length of post-spiracular setae: III 0·094, 0·121; V 0·109, 0·114; VI 0·207–0·222.

MATERIAL EXAMINED.

Holotype ♀, slide no. MAPS-1187, from *Garrulax merulinus* Blyth, THAILAND Doi Pha Hom Phok, Chiang Mai Province, 20.x.1965 (USNM).

Myrsidea sikkimensis sp. n.

(Pl. 2, fig. 61; Text-figs 11, 19, 51)

Type-host: *Garrulax striatus sikkimensis* (Ticehurst).

The two males on which this description is based are readily separable by the genital sclerite, the characters of the hypopharynx and chaetotaxy from other *Myrsidea* males described here.

♂. Hypopharynx considerably reduced. Head seta 10 extends well beyond the middle of seta 11 and is relatively longer than in most species (Text-fig. 11). In the genitalia, of which the genital sac is everted, the parameres are curved posteriorly and of characteristic shape anteriorly, as is the inwardly directed arm of the basal apodeme (Text-fig. 51); genital sclerite also distinctive, apparently without posterior processes as are found in *erythrocephali*. Metasternal plate similar to that of *bhutanensis*.

The chaetotaxy and measurements of the holotype are given first, followed by that of the paratype where the two differ.

Metanotal setae 2 + 2; metapleural setae 2 + 2, 3 + 2; metasternal setae 7, 5; outer dorsal setae of tibia I 4 + 4; setae of femoral brush 17 + 16, 18 + 18.

ABDOMINAL CHAETOTAXY. Tergal setae: I, 2 + 2; II, 11, 6 ?; III, 12, 11; IV, 15, 12; V, 14, 13; VI, 10; VII, 11, 9; total of II–VII, 73, 71; VIII, 6, 5, the tips of the central setae either fall slightly short of or just reach to the posterior margin of tergum IX (Text-fig. 19); IX, terminal 4. Pleural setae: anterior setae absent; proportions of outer and inner setae on pleurite VIII as in *erythrocephali*, only the outer one may also be slightly shorter. Sternal setae: I, 0, 1; II, anterior 19, 13; marginal 14, 11; aster 4 + 5, 4 + 4. Central and marginal setae on the sternites as follows: central anterior; III–VI, absent; VII, 4, 6; VIII, 1, 3. Central marginal: III, 12, 9; IV, V, 11, 13; VI, 11; VII, 8, 6; VIII, 6, 5. Total of anterior and marginal setae: VII, 12; VIII, 7, 8. Setae in lateral sternal brushes on III–VII, Table VI. Total number on VII, 23, 21. Setae in genital region 7 + 10, 7 + 8.

MEASUREMENTS of holotype and paratype. *Length*: total 1·64, 1·61; head 0·324, 0·318. *Breadth*: preocular 0·365, 0·38; temples 0·51; pronotum 0·34, 0·33; metanotum 0·45, 0·44; broadest tergite 0·60, 0·58. Length of post-spiracular setae: III 0·136–0·168, x̄ 0·151 (4); V, 0·114–0·136, x̄ 0·128 (3); VI 0·185–0·222, x̄ 0·206 (4).

MATERIAL EXAMINED.

Holotype ♂, slide no. 19942*a*, from *Garrulax striatus sikkimensis* (Ticehurst), SIKKIM: Chungtang, 16.ii.1952 (*R. Meinertzhagen*) (BMNH).

Paratype. 1♂, with data as given for holotype.

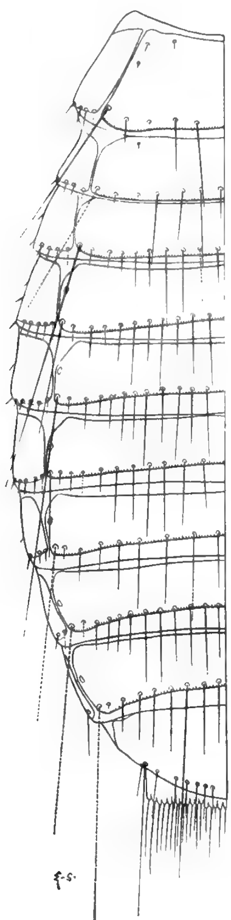
Myrsidea singularis sp. n.

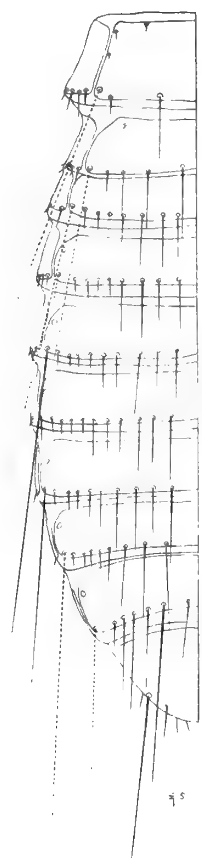
(Pl. 1, fig. 56; Text-figs 4, 12, 14, 17, 32, 45, 53)

Type-host: *Garrulax s. subunicolor* (Blyth).

The female of this species is at once distinguished from all others dealt with here by the enlarged metanotum and the 9–11 long to very long setae on pleurite I, which form a characteristic dorsal frill, and in the male by the details of the chaetotaxy and the genital sclerite.

♀ and ♂. Hypopharynx greatly reduced. In the female the metanotum and tergum I are considerably enlarged and terga II–IV are modified. This is the only species among those described here in which the metanotum in the female is wider than the broadest abdominal tergite (Text-fig. 4), consequently the shape of the female body is distinctive. Vulval margin strongly serrated, except for the extreme lateral edges. Microtrichia of genital chamber somewhat as in *M. antiqua* Ansari (see Clay, 1966: fig. 23) but individual combs are wider across and have slightly shorter microtrichia. Spermathecal duct and genital papilla apparent in only two females, in one (Text-fig. 32) their position as in other species, in the other these structures are reversed, presumably by distortion. In the male genitalia (Text-fig. 45) the parameres are rather

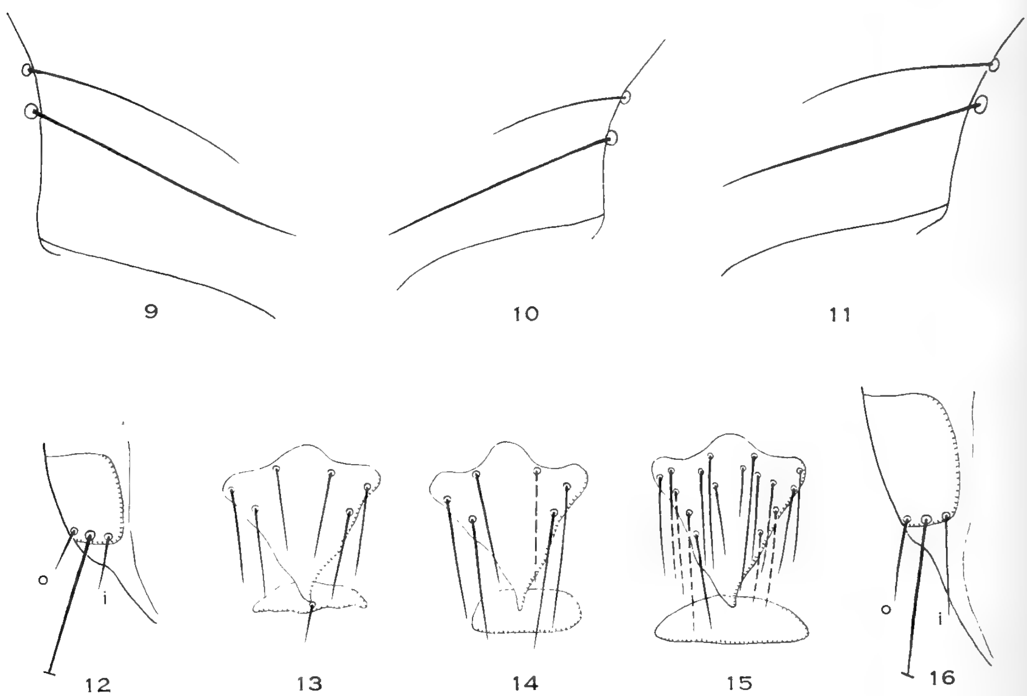




Figs 7–8. *Myrsidea macraidoia*, from type-host, dorsal. 7 (left), ♀; 8, ♂.

straight, anteriorly rounded and the inwardly directed arm of the basal apodeme is long and does not taper posteriorly. Male genital sclerite and the two posterior processes distinctive (Text-fig. 53). Apex of metasternal plate normal or slightly produced (Text-fig. 14). Metanotal setae: ♀ 16–19, $\bar{x}$ 17·60 (5), this being the greatest number among the forms dealt with here; ♂ 8–9 (4). Metapleural setae: ♀ 3–4, $\bar{x}$ 3·70 (10 sides); ♂ 2 (8). Metasternal setae: ♀ 7–8 (5); ♂ 3 + 3 (4). Outer dorsal setae of tibia I: ♀ and ♂, 3–5, $\bar{x}$, ♀ 4·10 (10 tibiae), ♂ 4·25 (8). Setae of femoral brush: ♀ 14–18, $\bar{x}$ 15·80 (10 femora); ♂ 13–15, $\bar{x}$ 14 (8).

Abdominal Chaetotaxy. Tergal setae (Text-figs 4, 17): ♀ (5); I, 2 + 2 and one specimen with 4 + 2, the 2 central setae normally short to moderately long and finer than the outer setae, but the five specimens show some variation in size and length of these setae; II, 18–20, $\bar{x}$ 18·80; III, 18–21, $\bar{x}$ 19·40; IV, 17–21, $\bar{x}$ 18·80; V, 15–20, $\bar{x}$ 16·20; VI, 15–19, $\bar{x}$ 17·20; VII, 12–17, $\bar{x}$ 13·75 (4); total of II–VII, 98–113, $\bar{x}$ 104 (4); VIII, 8–9, $\bar{x}$ 8·20; IX, 2 long. ♂ (4); I, 6–7, $\bar{x}$ 6·25; II, 12–16, $\bar{x}$ 13·25; III, 12–15, $\bar{x}$ 13–50; IV, 11–14, $\bar{x}$ 13; V, 11–15, $\bar{x}$ 13; VI, 11–13, $\bar{x}$ 12; VII, 9–11, $\bar{x}$ 10·50; total of II–VII, 70–82, $\bar{x}$ 75·25; VIII, 5–6, $\bar{x}$ 5·75; IX, terminal 4. The tips of the two central setae on tergum VIII fall a little or much short of the posterior margin of tergum IX in the female and may reach or just cross it in the male. Pleural setae: ♀; anterior setae present on pleurites III or IV–VII; III, 0–3; IV, 2–4; V, 1–5; VI, 1–4; VII, 1–2. Marginal setae: I, 10–12, $\bar{x}$ 10·60 (10 sides), of these the innermost is spiniform and moderately long, the rest (9–11) are long to very long, forming a characteristic dorsal frill; VIII, 1–2 short, extra inner setae each side. ♂; pleurites III–VII without anterior setae. Marginal setae: I, 4–5 (8), of normal size. In both sexes the relative proportions of outer and inner setae on pleurite VIII as in Text-fig. 12.



Figs 9–16. *Myrsidea* species. 9–11, head setae 10 and 11. 9, *macraidoia* ♀ from *G. albogularis whistleri*. 10, *sehri* Ansari, ♀, holotype. 11, *sikkimensis* ♂. 12, 16, pleurite VIII, inner (i), outer (o) setae, ♂. 12, *singularis*, 16, *macraidoia* from type-host. 13–15, metasternal plate, ♂ 13, *manipurensis*. 14, *singularis*. 15, *orientalis* from type-host.

Sternal setae. ♀ (5): II, anterior 13–18, x̄ 15·20, all central; marginal 14–17, x̄ 16·40; total of anterior and marginal 29–35; aster 2–5, x̄ 3·70 (10 asters); III–VII, Tables I, IV; total number on VII, 37–45, x̄ 40·80; genital region 14–20, x̄ 17·60; vulval marginal, each side 4–5, total 8–10, those of the two sides separated by a wide gap. ♂ (4): II, anterior 18–21, x̄ 20; marginal 14–16, x̄ 15·25; total of anterior and marginal 33–37; aster 2–3, x̄ 3·12 (8); III–VII or VIII, Tables II, VI; total number on VII, 27–34, x̄ 30·25; genital region 13–15.

MEASUREMENTS of 5♀ and 4♂. *Length*: total, ♀ 1·73–1·84, x̄ 1·79; ♂ 1·47–1·51, x̄ 1·48. Head, ♀ 0·30–0·312, x̄ 0·309; ♂ 0·288–0·294, x̄ 0·291. *Breadth*: preocular, ♀ 0·35–0·365, x̄ 0·358; ♂ 0·32–0·33, x̄ 0·327. Temples, ♀ 0·52–0·53, x̄ 0·524; ♂ 0·465–0·47, x̄ 0·467. Pronotum, ♀ 0·34–0·35, x̄ 0·346; ♂ 0·318–0·324, x̄ 0·321. Metanotum, ♀ 0·63–0·665, x̄ 0·65; ♂ 0·435–0·45, x̄ 0·44. Bradest tergite: ♀ 0·60–0·62, x̄ 0·613; ♂ 0·535–0·55, x̄ 0·54. Length of post-spiracular setae: ♀, III 0·185–0·247, x̄ 0·204 (7); V 0·133–0·158, x̄ 0·143 (7); VI 0·138–0·168, x̄ 0·152 (9); VII 0·148–0·178, x̄ 0·165 (8). ♂, III 0·160–0·183, x̄ 0·172 (7); V 0·116–0·141, x̄ 0·126 (8); VI 0·131–0·165, x̄ 0·145 (7); VII 0·148–0·190, x̄ 0·172 (6). Post-spiracular III longer than VI (in the female than VII also), this being the only species in which III is longer than VII.

This is an interesting species; attention has already been drawn to some of its unusual features, others are discussed below:– Those species (*sehri*, *erythrocephali*, *manipurensis* and *duplicata*) which normally have 2 + 2 setae on tergum I in the female also have the same number in the male. In this form, however, while the female normally has 2 + 2 setae on tergum I, the male has an additional seta each side between the central seta and that mediad to the post-spiracular seta, this seta being identical in proportions to the two central setae. This is the only species here described exhibiting sexual dimorphism in the number of setae on tergum I. The other difference in the chaetotaxy of tergum I of the two sexes—the proportions of the two central and two lateral setae—is also shown by *manipurensis*. The presence of two very long setae on tergum VIII in both sexes, which extend greatly beyond the posterior margin of tergum IX, is associated with anterior setae on the pleurites in both sexes of *bhutanensis*, *assamensis*, *orientalis* and *macraidoia*. The reverse, the absence of very long setae on tergum VIII associated with the absence of anterior pleural setae, is found in both sexes of *erythrocephali*, *manipurensis* and *duplicata*, the female of *thailandensis* and the male of *sikkimensis*. This arrangement also occurs in male *singularis*, but the female is exceptional in having anterior pleural setae without at the same time having two very long setae on tergum VIII.

MATERIAL EXAMINED.

Holotype ♀, slide no. 19938, from *Garrulax s. subunicolor* (Blyth), SIKKIM: Chungtang, 16.ii.1952 (*R. Meinertzhagen*) (BMNH).

Paratypes. 4♀, 4♂, from *G. s. subunicolor*, SIKKIM: Lachen, 26.ii.1952 (*R. Meinertzhagen*, 20023) (BMNH).

Myrsidea bhutanensis sp. n.

(Pl. 2, fig. 62; Text-figs 18, 22, 46)

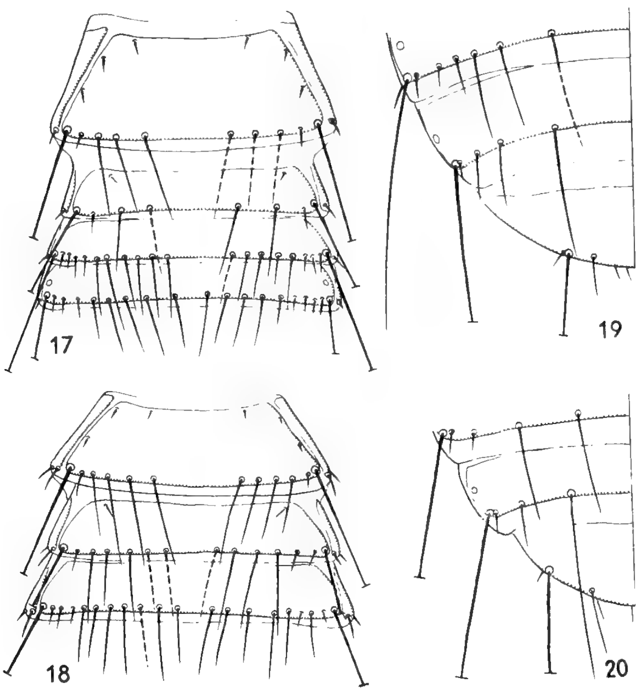
Type-host: *Garrulax ruficollis* (Jardine & Selby).

This form is distinguished from the other species with a fully developed hypopharynx by the form and chaetotaxy of tergum I (*manipurensis*) or by details of the

chaetotaxy (*duplicata* and *patkaiensis*) in the female, by the chaetotaxy and the genital sclerite in the male.

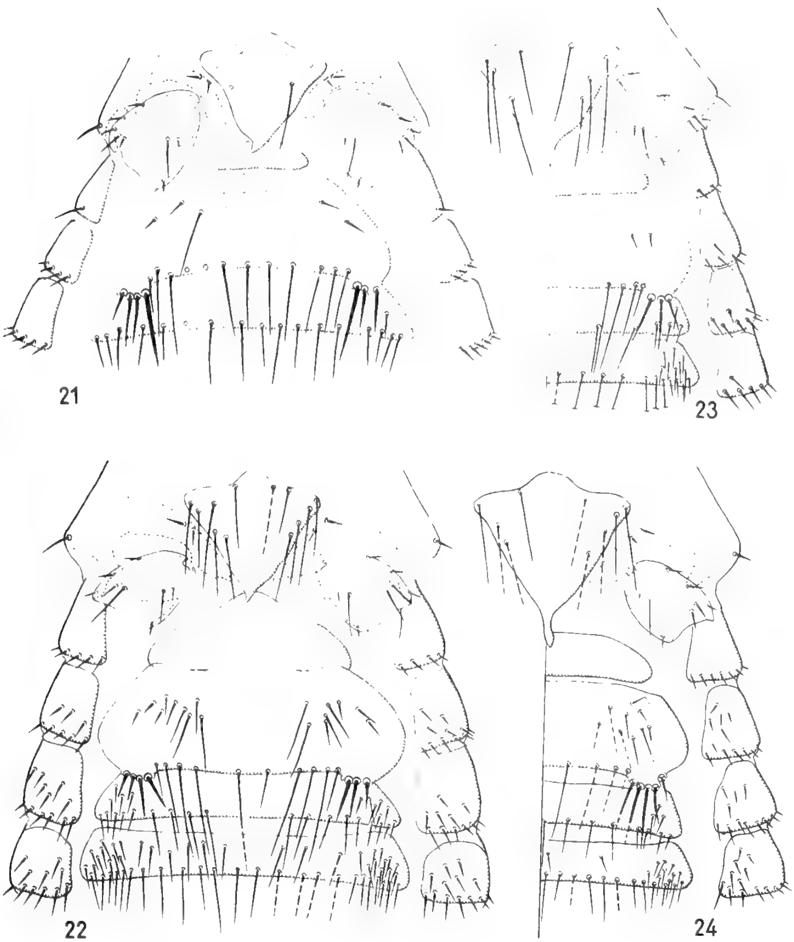
♀ and ♂. Hypopharynx fully developed. In the female tergum I very slightly enlarged and II normal; vulval margin moderately serrated both medially and laterally; only in one specimen is the opening of the spermathecal duct visible and therefore presumably the duct opens on a genital papilla (see page 372). In the male genitalia (Text-fig. 46) the parameres are of characteristic shape due to a rather abrupt narrowing of the outer margin, but anteriorly somewhat as in *erythrocephali*, the inwardly directed arm of the basal apodeme as in *orientalis* and margin of the endomeral plate unlike all other species except *monilegeri*. Genital sclerite distinctive, no posterior pointed processes apparent. Apical portion of metasternal plate in the female as in Text-fig. 22, in the male similar to that of *singularis*. Metanotal setae: ♀ 11–14, $\bar{x}$ 12·66 (3); ♂ 8–10 (4). Metapleural setae: ♀ 4–5, $\bar{x}$ 4·33 (6 sides); ♂ 2–4, $\bar{x}$ 3·25 (8). Metasternal setae: ♀ 12–14 (3); ♂ 9–12, $\bar{x}$ 10·25 (4). Outer dorsal setae of tibia I: ♀ and ♂, 5–6, $\bar{x}$, ♀ 5·16 (6 tibiae), ♂ 5·25 (8). Setae of femoral brush: ♀ 27–35, $\bar{x}$ 31·66 (6 femora); ♂ 23–33, $\bar{x}$ 27·43 (7).

ABDOMINAL CHAETOTAXY. Tergal setae: ♀; I, 12–13, $\bar{x}$ 12·66 (3); II, 20–23, $\bar{x}$ 21·33 (3); III, 21–22, $\bar{x}$ 21·33 (3); IV, 19–21, $\bar{x}$ 20·33 (3); V, 20 (2); VI, 18, 21 (2); VII, 15, 16 (2); total of II–VII, 115, 120 (2); VIII, 9–10, x 9·33 (3) of which 1–2 are very long extending well beyond the posterior margin of tergum IX; IX, 2–5 short to long, $\bar{x}$ 3·66 (3). ♂; I, 9–13, $\bar{x}$ 11·25 (4); II, 13, 18 (2); III, 15–20, $\bar{x}$ 17·25 (4); IV, 16–19, $\bar{x}$ 17·25 (4); V, 15–17, $\bar{x}$ 16 (3); VI, 15–19, $\bar{x}$ 16·66 (3); VII, 15–17, $\bar{x}$ 15·66 (3); total of II–VII, 90, 100 (2); VIII, 8–9, $\bar{x}$ 8·25 (4), of the two central setae which are unbroken (6) five are very long extending well beyond the posterior margin of tergum



FIGS 17–20. *Myrsidea* species, ♂ dorsal. 17, 18, metathorax and anterior abdominal segments. 17, *singularis*. 18, *bhutanensis*. 19, 20, terminal segments of abdomen. 19, *sikkimensis*. 20, *patkaiensis* from type-host.

IX and one not reaching this margin; IX, terminal 5 (4). Pleural setae: anterior setae present on pleurites II–VII in the female and in the male always on IV and V, usually on II, III and VI, and occasionally on VII. VIII: ♀, 0–1 extra inner setae each side; proportions of outer and inner setae in both sexes approximately as in *erythrocephali*. Sternal setae. ♀: II, anterior 3 or 4 + 5, 2 + 2, 7 + 7, laterally on the sternite, those of the two sides being separated by a large gap (the arrangement being similar to that in female of *assamensis*); marginal 9–10, arranged characteristically as follows: 1–2 centrally and 4–5 laterally, a gap separating the central from lateral setae (Text-fig. 22); total of anterior and marginal 14–24, $\bar{x}$ 18·66 (3); aster 3–4, $\bar{x}$ 3·66 (6 asters). Central and marginal setae on sternites III–VII as follows (1–3): central anterior; III, absent; IV, 9; V, 10, 9; VI, 11, 10; VII, 9, 12. Central marginal: III, 6–8 (3); IV, 10, 11; V, 12 (2); VI, 11, 9; VII, 8, 7. Total of anterior and marginal setae: IV, 20 (1); V, 22, 21; VI,



21 23 22 24

FIGS 21–24. *Myrsidea* species, metathorax and anterior abdominal segments, ventral. 21, *sehri* Ansari, ♂, allotype. 22, *bhutanensis* ♀. 23, *patkaiensis*, ♀, from type-host. 24, *assamensis*, ♀, from type-host.

B*

22, 19; VII, 17, 19. Sternal brushes, Table IV. Total number on VII, 34, 32. Genital region 15–17 (3); vulval marginal, each side 6–7, total 13, those of the two sides separated by a narrow gap. On III the central marginal setae are arranged characteristically, 3–4 each side, separated by a gap (as in *patkaiensis*). ♂ (4): II, anterior 23–29, $\bar{x}$ 25·50; marginal 15–17, $\bar{x}$ 15·75; total of anterior and marginal 38–44; aster 4 + 4; III–VII or VIII, Tables II, VI; unlike the previous species central anterior setae are normally present on sternite III; total number on VII, 33–39, $\bar{x}$ 35 (3); genital region 14–26, $\bar{x}$ 20·25.

MEASUREMENTS of 3♀ and 4♂. *Length*: total, ♀ 1·70–1·90, $\bar{x}$ 1·83; ♂ 1·55–1·67, $\bar{x}$ 1·61. Head, ♀ 0·32–0·335, $\bar{x}$ 0·326; ♂ 0·29–0·32, $\bar{x}$ 0·306. *Breadth*: preocular, ♀ 0·34–0·36, $\bar{x}$ 0·35; ♂ 0·315–0·33, $\bar{x}$ 0·32. Temples, ♀ 0·50–0·535, $\bar{x}$ 0·52; ♂ 0·435–0·49, $\bar{x}$ 0·47. Pronotum, ♀ 0·32–0·35, $\bar{x}$ 0·338; ♂ 0·28–0·32, $\bar{x}$ 0·30. Metanotum, ♀ 0·48–0·51, $\bar{x}$ 0·50; ♂ 0·36–0·42, $\bar{x}$ 0·39. Broadest tergite: ♀ 0·665–0·73, $\bar{x}$ 0·70; ♂ 0·52–0·61, $\bar{x}$ 0·57. Length of post-spiracular setae: ♀, III 0·210–0·260, $\bar{x}$ 0·242 (5); V 0·148–0·175, $\bar{x}$ 0·160 (5); VI 0·247–0·272, $\bar{x}$ 0·260 (5). ♂, III 0·190–0·222, $\bar{x}$ 0·202 (8); V 0·143–0·158, $\bar{x}$ 0·151 (7); VI, 0·217–0·311, $\bar{x}$ 0·258 (8). These are longer than in *duplicata* and *manipurensis*.

MATERIAL EXAMINED.

Holotype ♀, slide no. 19847*a*, from *Garrulax ruficollis* (Jardine & Selby), INDIA: Kangpokpi, Manipur, Assam State, 26.i.1952 (*R. Meinertzhagen*) (BMNH).

Paratypes. 1♀, 2♂, with data as given for holotype (BMNH); 1♀, 2♂ from *G. ruficollis*, BHUTAN: Somchi, 25.xi.1968 (EC).

Myrsidea monilegeri sp. n.

(Text-figs 26, 28, 50, 52)

Type-host: *Garrulax monileger fuscatus* Baker.

Known only from the male, the genital sclerite distinguishes this sex from that of *assamensis* and other species parasitic on *Garrulax* in which the hypopharynx is reduced and anterior setae are present on the pleurites.

♂. Hypopharynx considerably reduced. Male genitalia as shown in Text-fig. 50; genital sclerite (Text-fig. 52) somewhat twisted yet it is unmistakably distinctive. Due to non-availability of other males it could not be confirmed whether the disinctive shape of the endomeral plate is real or caused by the slight outward pulling of the genital sac, and whether the relatively smaller size and anteriorly broader shape of the parameres are real or artefacts due to their being curved in the vertical plane. Metasternal plate is in *erythrocephali*. Metanotal and metapleural setae 2 + 2; metasternal setae 3 + 3; outer dorsal setae of tibia I 5 + 5; setae of femoral brush 29 + 26.

ABDOMINAL CHAETOTAXY. Tergal setae: I, 7; II, VII, 11; III, V, 13; IV, VI, 12; VIII, 4 + 3, the two central setae are very long and their ends extend greatly beyond the posterior margin of tergum IX; IX, terminal 5. Pleural setae: anterior setae present on pleurites III–VI (Text-fig. 28) and their number (III, 4 + 3; IV, VI, 4 + 5; V, 3 + 5; VII, 2 + 3) is distinctly greater than in *assamensis*. VIII, 0 + 1 extra inner seta; outer and inner setae as in Text-fig 26.. Sternal setae. II, anterior 27; marginal 20; aster 5 + 5. Central setae on sternites: III, anterior absent, marginal 15; IV, anterior 10, marginal 12; V, 11, 11; VI, 9, 11; VII, 9, 9; VIII, 2, 5. Setae in lateral brushes: III, anterior 4 and marginal 5 on one side +3 and 3 respectively on other side; IV, 15, 7 + 12, 7; V, 15, 7 + 15, 8; VI, 13, 6 + 14, 6; VII, 6, 3 + 6, 3; VIII, 0, 1 + 0, 1. Total number on VII, 36; genital region 8 + 7.

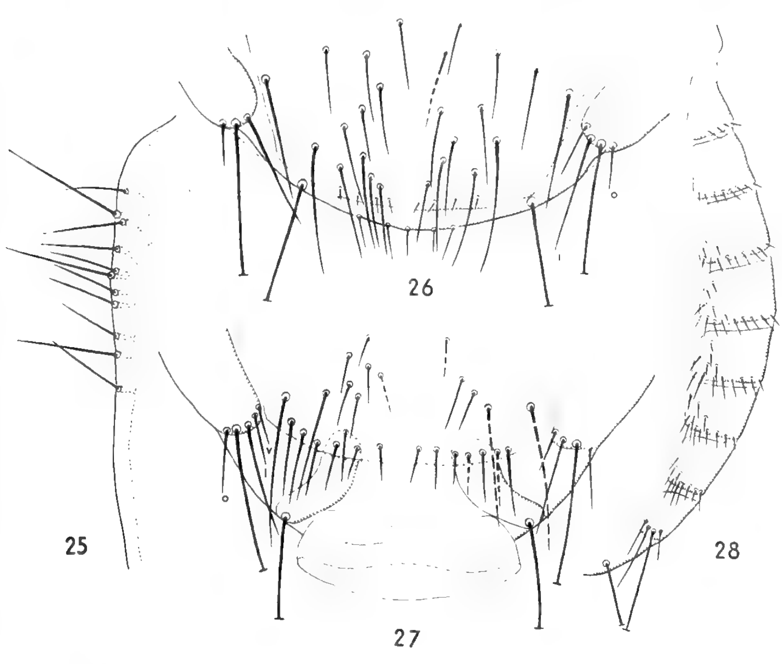
MEASUREMENTS of the ♂ holotype. *Length*: total 1·59; head 0·32. *Breadth*: preocular 0·33; temples 0·48; pronotum 0·32; metanotum 0·42; tergite V 0·65. Length of post-spiracular setae:

III 0·235, 0·260; V 0·138, 0·180; VI, 0·335, 0·412; III and VI are relatively longer than in previous species.

MATERIAL EXAMINED.

Holotype ♂, slide no. RE-1408, from *Garrulax monileger fuscatus* Baker, THAILAND: Tha Kanun Hin Laem, Kanchanaburi Province (*R. E. Elbel* & *H. G. Deignan*) (USNM).

Two *Myrsidea* females, slide nos RE-4238, 4513, from *G. monileger schauenseei* Delacour & Greenway (THAILAND: Loei Province, 31.x.1954, 18.i.1955 (*R E. Elbel*) (REC)) have the hypopharynx considerably reduced, tergum I normal, vulval margin feebly serrated, spermathecal duct opening in a bursa copulatrix, metasternal plate as in *erythrocephali* and the chaetotaxy as follows: metanotal setae 2 + 2, 1 + 2 (as inner seta absent on left-hand side); metapleural setae 4 + 4, 4 + 3 (outer most seta on left-hand side minute); metasternal setae 6, 8; outer dorsal setae of tibia I 5 + 5; setae of femoral brush 33 + 30, 29 + 27. Tergal setae: I, 11; II, 12, 9; III, 13, 11; IV, 12; V, 14, VI, 14, 12; VII, 9, 10; total of II–VII, 74, 68; VIII, 3 + 2, 3 + 3, the two central setae (broken on left-hand side in one) are very long and their ends extend greatly beyond the posterior margin of tergum IX; IX, 2 + 2, probably 3 + 3, long. Pleural setae: anterior setae present on pleurites II or III–VII; VIII, extra inner setae 2 + 1, 1 + 1, short to moderately long; outer and inner setae as in Text-fig. 27. Sternal setae. II, anterior 4 + 2, 3 + 3; marginal 15; aster 5 + 5, 4 + 4. Anterior setae on sternite II medio-lateral but not close to the 2 + 2 constant setae, those of the two sides separated by a small gap (Text-fig. 30). Their position is intermediate between that in *assamensis* and species having these setae



FIGS 25–28. *Myrsidea* species. 25, *orientalis*, ♂, from type-host, tibia I. 26, 27, *monilegeri*, genital region. 26, ♂, from type-host. 27, ♀, from *G. monileger schauenseei* (corona of anal setae omitted). 28, *monilegeri*, ♂, from type-host, pleurites I–VIII, ventral. i, inner seta; o, outer seta.

centrally (*erythrocephali* and *singularis*). Central and marginal setae on sternites III–VII as follows: central anterior; III, absent; IV, 7, 8; V, 9, 11; VI, 9; VII, 6. Central marginal; III, 10 9; IV, 11, 12; V, VI, 10; VII, 8. Total of anterior and marginal setae; IV, 18, 20; V, 19, 21; VI, 19; VII, 14. Total number on VII, 26, 28; genital region 8 + 5, 6 + 7; vulval marginal 14, 16, either the row is continuous or with a narrow median gap (Text-fig. 27). Marginal setae on sternite II and III in the form of a continuous row, as in *assamensis*.

MEASUREMENTS of 2♀. *Length*: total 1·92, 1·935; head 0·335, 0·34. *Breadth*: preocular 0·37, 0·39; temples 0·535, 0·56; pronotum 0·35, 0·37; metanotum 0·51, 0·53; broadest tergite 0·77. Length of post-spiracular setae: III 0·269–0·326, x̄ 0·293 (4); V 0·178–0·242, x̄ 0·202 (4); VI 0·330–0·412, x̄ 0·371 (4).

These females can be distinguished from those of all other taxa described here by the details of the chaetotaxy and have therefore been included in the key. As they share four characters (considerably reduced hypopharynx, anterior setae on the pleurites, two very long central setae on tergum VIII, the relative proportions of head setae 10 and 11) with the male of *monilegeri*, there is reasonable likelihood of their being that species. But *monilegeri* comes from a subspecifically different host, and as populations on subspecifically distinct birds are not always conspecific, the true status of these females, which are excluded from the type-series of *monilegeri*, must remain in abeyance until the availability of either females from the type-host of *monilegeri* or males from *G. m. schauenseei*.

Myrsidea assamensis sp. n.

(Pl. 1, fig. 57, Pl. 2, fig. 63; Text-figs 5, 24, 44)

Type-host: *Garrulax l. leucolophus* (Hardwicke).

This species resembles most closely *patkaiensis*, the distinguishing characters being given under that species. It is distinguished from those species parasitic on *Garrulax* (especially *monilegeri*) with a reduced hypopharynx as well as anterior setae on the pleurites by the details of the chaetotaxy, the arrangement of the setae on sternites II and III in the female being the most important, and by the genital sclerite in the male.

♀ and ♂. Hypopharynx considerably reduced but sometime to a greater extent in the female. In the female terga I and II normal; vulval margin entirely serrated, moderately so over the greater median portion and feebly laterally; the spermathecal duct and bursa copulatrix are not visible. In the male genitalia (Text-fig. 44) the parameres are strongly curved, generally rounded anteriorly, the inwardly directed arm of the basal apodeme is long and tapers posteriorly. In this species and three others (*monilegeri*, *patkaiensis* and *orientalis*) the genital sclerite is rather similar, having an anterior loop-like structure the outer arm of which is relatively dorsal and the inner relatively ventral, the difference being shown in the posterior part of the inner arms which in this species are partly fused (Pl. 2, fig. 63). Apex of metasternal plate greatly elongated in the female (Text-fig. 24), slightly less so in the male, being more elongated than in any other species dealt with here. Metanotal setae: ♀ (4), ♂ (4), 2 + 2. Metapleural setae: ♀ 4 (8 sides); ♂ 2 (8 sides). Metasternal setae: ♀ 9–10 (4); ♂ 7–10, x̄ 8·25 (4). Outer dorsal setae of tibia I: ♀ and ♂, 5–6, x̄, ♀ 5·14 (7 tibiae), ♂ 5·25 (8). Setae of femoral brush: ♀ 24–27, x̄ 26·50 (8 femora); ♂ 22–25, x̄ 23·62 (8).

ABDOMINAL CHAETOTAXY. Tergal setae: ♀ (Text-fig. 5) (4); I, 2 + 2 (3), 2 + 3 (1), the 2 central setae long and much longer than the 2 short to moderately long lateral ones; II, 12–13, x̄ 11·75; III, 13–14, x̄ 13·25; IV, 12–14, x̄ 13; V, 12–14, x̄ 12·50; VI, 10–13, x̄ 11·75; VII, 8–9,

x̄ 8·75; II–VII, total 68–74, x̄ 70·75; VIII, 5–6, x̄ 4·75; IX, each side 2–4, total 4–8, x̄ 6. ♂ (4); I, 2 + 2; II, 7–8, x̄ 7·50; III, 10–11, x̄ 10·50; IV, 9–11, x̄ 10·50; V, 10–11, x̄ 10·25; VI, 9–10, x̄ 9·75; VII, 7–8, x̄ 7·75; II–VII, total 54–58, x̄ 56·25; VIII, 4–5, x̄ 4·25; IX, terminal 5. In both sexes the two central setae on tergum VIII are very long and extend far beyond the posterior margin of tergum IX. Pleural setae: anterior setae present on pleurites II–VI or VII in both sexes and their number in the male is smaller (II, 1; III, 2–4, x̄ 2·83 (6 sides); IV, 2–4, x̄ 3·14 (7); V, 2–3, x̄ 2·25 (8); VI, 1–2, x̄ 1·13 (8); VII, 0–1, x̄ 0·75 (8)) than in *monilegeri*. VIII, ♀, 1–2 extra short to medium inner setae each side; in both sexes outer and inner setae approximately as in *monilegeri*. Sternal setae. ♀ (4): II, anterior 5–7, x̄ 5·87 (8 sides), laterally on the sternite (close to the 2 + 2 constant setae), those of the two sides separated by a large gap, total 11–13, x̄ 12 (one seta is present centrally on the sternite in one); marginal 9; total of anterior and marginal 20–22, x̄ 21; aster 3–5, x̄ 3·75 (8 asters). III–VII, Tables I, V. Marginal setae on sternites II and III form a continuous row (Text-fig. 24); on II the gap between adjoining marginal setae in the middle is relatively wider than that between the lateral ones. Total number on VII, 22–26, x̄ 24; genital region 13–15; vulval marginal, each side 7–9, total 15—16, x̄ 15·75, those of the two sides separated by a narrow gap. ♂ (4): II, anterior 28–34, x̄ 30·75; marginal 14–16, x̄ 15; total of anterior and marginal 43–48; aster 4–5, x̄ 4·62 (8 asters); III–VII or VIII, Tables III, VI. Central anterior setae always present on sternite III. Total number on VII, 25–31, x̄ 28·75; genital region 18–20.

MEASUREMENTS of 4♀ and 4♂. *Length*: total, ♀ 1·795–1·935, x̄ 1·88; ♂ 1·50–1·55, x̄ 1·53. Head ♀ 0·33–0·34, x̄ 0·337; ♂ 0·31–0·32, x̄ 0·318. *Breadth*: preocular, ♀ 0·36–0·37, x̄ 0·364; ♂ 0·335–0·34, x̄ 0·338. Temples, ♀ 0·53–0·55, x̄ 0·537; ♂ 0·477–0·488, x̄ 0·485. Pronotum, ♀ 0·35–0·37, x̄ 0·36; ♂ 0·32–0·33, x̄ 0·328. Metanotum, ♀ 0·535–0·565, x̄ 0·55 (3); ♂ 0·43–0·44, x̄ 0·432. Broadest tergite: ♀ 0·76, 0·77, x̄ 0·765 (2); ♂ 0·63–0·65, x̄ 0·64. Length of post-spiracular setae: ♀, III 0·252–0·323, x̄ 0·285 (8); V 0·126–0·190, x̄ 0·155 (8); VI, 0·304–0·365, x̄ 0·345 (3). ♂, III 0·217–0·308, x̄ 0·262 (7); V 0·136–0·158, x̄ 0·144 (8); VI 0·309–0·324, x̄ 0·316 (6).

MATERIAL EXAMINED.

Holotype ♂, slide no. 13945*a*, from *Garrulax l. leucolophus* (Hardwicke), INDIA: Dehradun, Uttar Pradesh, i.1940 (*R. Meinertzhagen*) (BMNH).

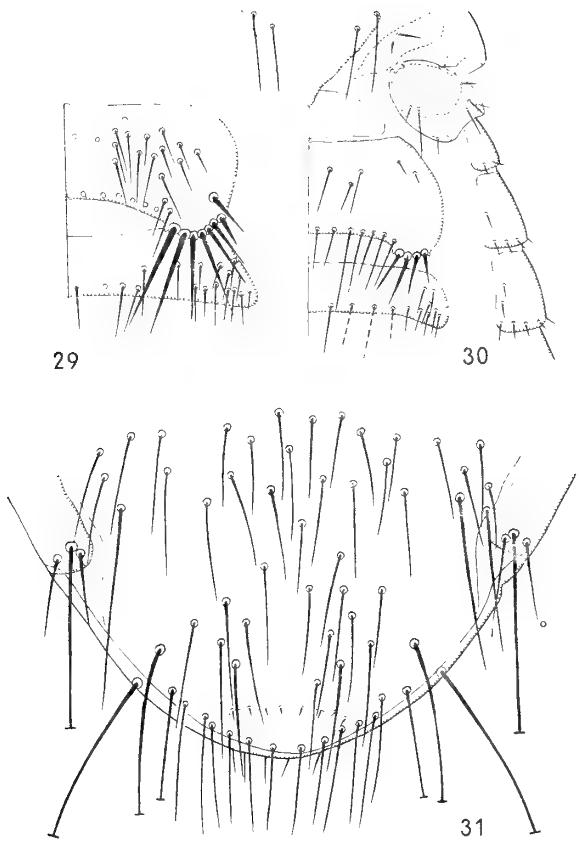
Paratypes. 3♂, 4♀, with data as given for holotype.

Specimens have also been seen from *Garrulax leucolophus patkaicus*, *G. l. belangeri*, *G. l. diardi* and a subspecifically unidentified *G. leucolophus*. While those from *G. l. patkaicus* have been described as a new species, those from the other hosts are discussed below and included in *M. assamensis* s. l.

The specimens from *G. l. belangeri* resemble *assamensis* in the form of the male genitalia, serrations of the vulval margin and the shape of the metasternal plate, but differ in having tergum I very slightly enlarged in the female and the hypopharynx slightly less reduced in both sexes. The spermathecal duct opens in a bursa copulatrix (Text-fig. 42), these structures not being visible in the nominate form. The measurements fall within the range of *assamensis* except for the metanotum (♀ 0·49–0·54, x̄ 0·52 (5); ♂ 0·38–0·40, x̄ 0.388 (5)) and broadest tergite (♀ 0·70–0·72, x̄ 0·71 (3); ♂ 0·55–0·60, x̄ 0·57 (5)) which are less wide, post-spiracular seta III in the female (0·185–0·254, x̄ 0·230 (10)) which is shorter and VI in the male (0·318–0·424, x̄ 0·363 (9)) which tends to be longer. As far as the chaetotaxy is concerned there tend to be fewer setae on tergum VIII (♀ 2 + 2 (9); ♂ 4–5, x̄ 4·25 (8)) and in the female on tibia I (4–5, x̄ 4·94 (16 tibiae)), but slightly more in the femoral brush in both sexes (♀ 25–32, x̄ 28·86 (15 femora); ♂ 23–30, x̄ 26·73 (15)) and significantly more on tergum IX in the female (9–13, x̄ 10·22 (9)). The pleural chaetotaxy is also

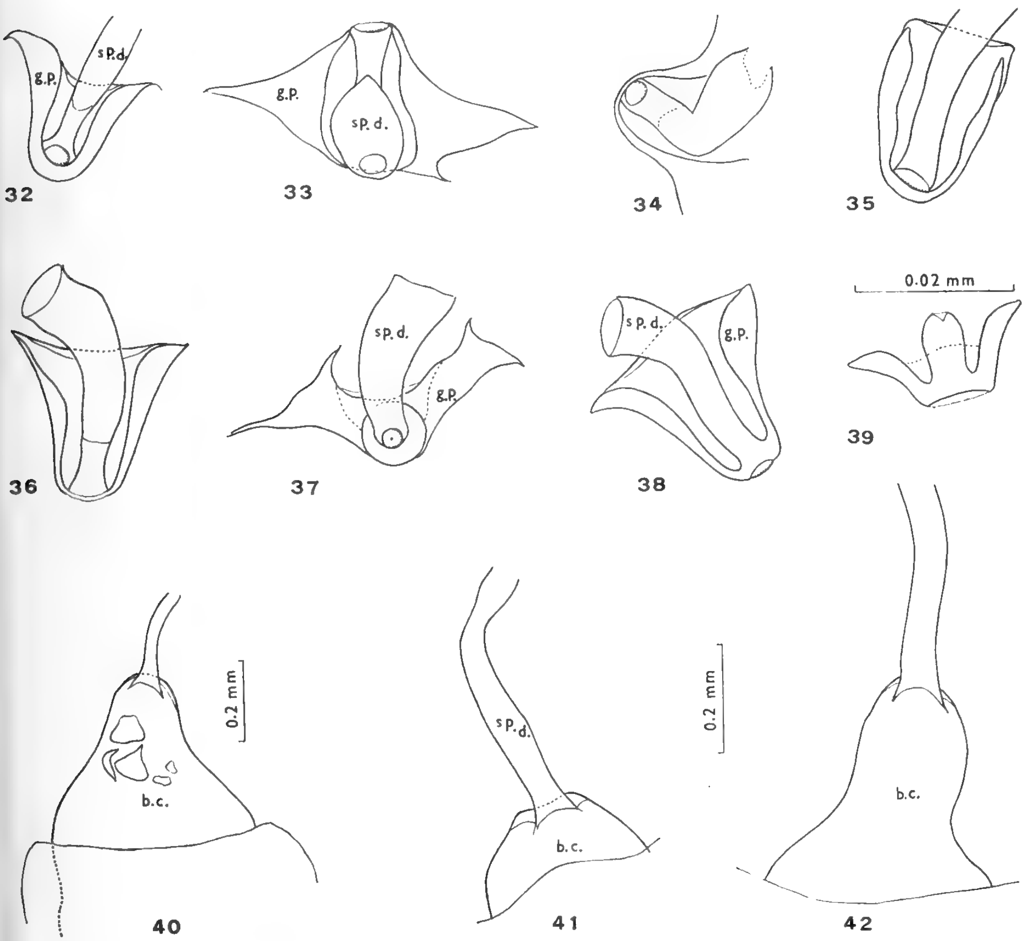
similar, although on VIII additional inner setae may be present in some males (1 + 1 (4), 0 + 1 (1), 0 (3)) and the inner seta may be slightly shorter. While the number of setae in both sexes and their arrangement in the female on sternite II agree closely with that of *assamensis* the number on sternites III–VII or VIII differs somewhat, that of the central anterior ones (1–5, $\bar{x}$ 2·25 (8)) on sternite III in the male and in the genital region (♀ 11–16, $\bar{x}$ 12·66 (9); ♂ 13–20, $\bar{x}$ 17 (8)) being somewhat smaller.

The specimens from *G. l. diardi* also resemble *assamensis* in the male genitalia and the shape of the metatasternal plate, but differ in having tergum I slightly enlarged in the female, less pronounced serrations of the vulval margin medially and the hypopharynx slightly less reduced in both sexes (Pl. 1, fig. 57). In these also the spermathecal duct opens in a bursa copulatrix. The measurements also agree well with *assamensis*, except for post-spiracular seta III which tends to be shorter



FIGS 29–31. *Myrsidea* species. 29, *orientalis*, ♂, from *G. pectoralis subfusus*, sternites II and III. 30, *monilegeri*, ♀, from *G. monileger schauenseei*, methathorax and anterior abdominal segments, ventral. 31, *macraidoia*, ♂, from type-host, genital region. i, inner seta; o, outer seta.

(♀ 0·188–0·280, x̄ 0·227 (10); ♂ 0·185–0·269, x̄ 0·223 (10)). While the number of setae on the metanotum, metapleurite (♀ 3–5, x̄ 3·97 (32 sides); ♂ 1–3, x̄ 1·98 (46)), tibia I (♀ 3–6, x̄ 5 (34 tibiae); ♂ 4–5, x̄ 4·85 (28)) and in the femoral brush (♀ 20–32, x̄ 25·43 (30 femora); ♂ 21–29, x̄ 24·46 (28)) agrees well, that on the metasternal plate tends to be smaller (♀ 6–9, x̄ 8 (16); ♂ 6–10, x̄ 7·81 (16)). The abdominal chaetotaxy differs in the number of marginal setae on tergum IX in the female (7–10, x̄ 8·37 (11)), which is distinctly greater, and in the presence of additional inner setae on pleurite VIII in the male (1 + 1 (6), 0 + 1 (6), 0 (10)). On sternite II there are fewer



FIGS. 32–42. *Myrsidea* species. 32–38, spermathecal duct and genital papilla. 32, *singularis* 33, 34, *erythrocephali*. 35, *manipurensis*. 36, 37, *duplicata*. 38, *M*. sp. from *P. ferruginosus*. 39, internal sclerite in ♀ genitalia of *sehri* Ansari, holotype. 40–42, spermathecal duct and bursa copulatrix. 40, *orientalis* from type-host. 41, *monilegeri* from *G. monileger schauenseei*. 42, *assamensis* from *G. leucolophus belangeri*. Scale above 39 applies to figs 32–39, that between 41 and 42 to both these figs. b. c., bursa copulatrix; g. p., genital papilla; sp. d., spermathecal duct; orientation of structures as in the preparation.

anterior setae in the male (21–31, x̄ 24·88 (16); marginal 13–16, x̄ 14·94 (16); total of anterior and marginal 36–47) and fewer setae in the aster (♀ 2–4, x̄ 3·23 (34 asters); ♂ 3–5, x̄ 4·22 (32)), in the female one seta of the aster on one or both sides may be slightly or well removed from the others. The number of setae on sternites II–VII in the female and II–VIII in the male differs somewhat, the central anterior setae not being always present on sternite III in the male (0 (7), 1–3, x̄ 2·11 (9) or 1·19 (16)) and setae on the vulval margin (11–15, x̄ 13·60 (15)) and in the genital region (10–18, x̄, ♀ 12·64 (14), ♂ 13·12 (16) being fewer).

In specimens from *G. leucolophus* subsp.? the male genitalia, hypopharynx and metasternal plate resemble closely those of *assamensis* but in the female tergum I is very slightly enlarged and the feebly serrated vulval margin has more pronounced serrations laterally than medially. The chaetotaxy in general agrees well, that of sternite II in the female and pleurite VIII in both sexes being typical of *assamensis*. Central setae on tergum VIII are missing, except on one side of one male which is long, the size of the alveoli of the missing setae indicating that they also were very long. However, the number of setae on certain parts (femoral brush, ♂ 24–31, x̄ 26·25 (8 femora); IX, ♂, terminal 4–5, x 4·50 (4); genital region, ♀ 8, 10 (2); ♂ 10–12 (4)) differs somewhat.

Detailed comparison shows that specimens from *G. l diardi* differ more from *assamensis* from the type-host than do those from *G. l. belangeri* but the differences are inadequate for their separation, as is also the case in specimens from *G. leucolophus*. Owing to their resemblance, therefore, to *assamensis* s. str. in the characters of the male genitalia, chaetotaxy of sternite II in the female, besides in several others, the specimens from *G. l. belangeri*, *G. l. diardi* and *G. leucolophus* subsp. ? have been included in *assamensis* s. l.

The data of this material, which is excluded from the type-series of *assamensis*, are listed below.

From *Garrulax leucolophus belangeri* Lesson, THAILAND: Tha Khanun Hin Laem, Kanchanaburi Province, 5♂, 8♀, 2.xi., 3.xi.1952 (*R. E. Elbel* & *H. G. Deignan*); 3♂, 1♀, 9.xi.1952 (*R. E. Elbel*) (EC and REC).

From *Garrulax leucolophus diardi* (Lesson), THAILAND: Chaiyaphum, Khon Kaen, Lampang, Lop Buri, Nakhon Phanom and Nan Provinces, 29 ♂, 42 ♀, between 29.xii.1951 and 7.vi.1955 (*R. E. Elbel* or *R. E. Elbel* & *H. G. Deignan* or *R. E. Elbel* & *B. Lekagul*) (EC and REC).

From *Garrulax leucolophus* (Hardwicke) subsp. ?, THAILAND: Nan Province, Ban ta Ler, 3♂, 1♀, 23.xi., 14.xii.1961; Ban Pha hang, 1♂, 1♀, 19.xii.1961 (*Kitti Thonglongya*) (EC).

Myrsidea patkaiensis sp. n.

(Text-figs 20, 23, 47, 54)

Type-host: *Garrulax leucolophus patkaicus* Reichenow.

This species is distinguished from *assamensis*, which it resembles most closely, by the fully developed hypopharynx, in the male by the genitalia and in the female by the arrangement of the central marginal setae on sternites II and III. Characters

which distinguish it from *bhutanensis*, the only other species having a fully developed hypopharynx as well as anterior setae on the pleurites, are given under that species.

♀ and ♂. Hypopharynx fully developed. In the female tergum I very slightly but perceptibly enlarged and tergum II very slightly modified; vulval margin feebly serrated medially, feebly to moderately laterally. Neither the spermathecal duct nor a bursa copulatrix is visible in either *patkaiensis* s. str. or s. l. Male genitalia as in *assamensis*, except for slight differences in the shape of the parameres where they articulate with the basal apodeme (Text-fig. 47) and the inner arms of the genital sclerite which are distinctive (Text-fig. 54). Apex of metasternal plate considerably produced in the female (Text-fig. 23) but only slightly in the male. Metanotal setae: ♀ 4 + 4 (2); ♂ 3 + 3 (3). Metapleural setae: ♀ 4–5, $\bar{x}$ 4·25 (4 sides); ♂ 3–4, $\bar{x}$ 3·16 (6). Metasternal setae: ♀ (2), ♂ (2), 8, 9. Outer dorsal setae of tibia I: ♀ (2), ♂ (3), 5 + 5. Setae of femoral brush: ♀ 24–30, $\bar{x}$ 27 (4 femora); ♂ 22–30, $\bar{x}$ 26·66 (6).

Abdominal Chaetotaxy. Tergal setae: ♀ (2); I, 3 + 3, 3 + 2, the 2 central setae long and considerably longer than the short to moderately long seta each side mediad to the post-spiracular seta; II, 15, 11; III, 16, 19; IV, 17, 12; V 15 ;VI, 11, 13; VII, 8, 9; total of II–VII, 82, 79; VIII, 2 + 2; IX, 2, 3. ♂ (3); I, 6–7, $\bar{x}$ 6·33; II, 9–10, $\bar{x}$ 9·66; III, V, 11–12, $\bar{x}$ 11·33; IV, 12; VI, 10–11, $\bar{x}$ 10·33; VII, 7; total of II–VII, 60–63, $\bar{x}$ 61·66; VIII, 2 + 2 (2), 2 + 3 (1); IX, marginal 2–3, $\bar{x}$ 2·66, terminal 4. In both sexes the 2 central setae on tergum VIII are very long and extend considerably or well beyond the posterior margin of tergum IX (Text-fig. 20). Pleural setae: ♀ (2); anterior setae present on the pleurities; II, 0–3, $\bar{x}$ 1·25; III, 2–3, $\bar{x}$ 2·25; IV, 1–3, $\bar{x}$ 2·25; V, 1–3, $\bar{x}$ 1·75; VI, 0–2, $\bar{x}$ 0·75 each side. VIII, 0 + 1, 1 + 1 short, extra inner setae. ♂; on pleurites IV–VI only one anterior seta occurring on one or both sides. VIII, one specimen with 1 extra moderately long seta on one side. Outer and inner setae on VIII approximately as in *erythrocephali* in both sexes. Sternal setae. ♀ (2): II, anterior absent; marginal 7; aster 3 + 3 Central and marginal setae on sternites III–VII as follows: central anterior; II I, absent; IV, 1; V, 6, 7; VI, 7; VII, 7, 5. Central marginal: III, 3, 4; IV, 6, 8; V, 9, 8; VI, 7, 9; VII, 5, 6. Total of central and marginal setae: IV, 7, 9; V, 15; VI, 14, 16; VII, 12, 11. On sternite II the 7, and on III the 3–4 central marginal setae arranged as follows: on II 3–4, on III 1–2 each side and those of the two sides separated by a large gap (Text-fig. 23); arrangement on II distinctive and on III resembles that in *bhutanensis*. Sternal brushes, Table V. Total number on VII, 21 18. Genital region 11, 12; vulval marginal, each side 4–5, total 9 those of the two sides separated by a large median gap. ♂ (3): II anterior 23–28, $\bar{x}$ 25·66; marginal 15–16; total of anterior and marginal 39–43, $\bar{x}$ 41; aster 3–4, $\bar{x}$ 3·83 (6 asters); III–VII or VIII, Tables III, VI; total number on VII, 28, 25 (2); genital region 14–17, $\bar{x}$ 15·66.

Measurements of 2♀ and 3♂. *Length*: total, ♀ 1·65, 1·68; ♂ 1·38–1·455, $\bar{x}$ 1·42. Head, ♀ 0·34; ♂ 0·29–0·31, $\bar{x}$ 0·30. *Breadth*: preocular, ♀ 0·37; ♂ 0·32–0·335, $\bar{x}$ 0·327. Temples, ♀ 0·53, 0·55; ♂ 0·47–0·48, $\bar{x}$ 0·477. Pronotum, ♀ 0·33; ♂ 0·29–0·31, $\bar{x}$ 0·30. Metanotum, ♀ 0·50, 0·51; ♂ 0·37–0·38, $\bar{x}$ 0·374. Broadest tergite: ♀ 0·70, 0·71; ♂ 0·51–0·535, $\bar{x}$ 0·522. Length of post-spiracular setae: ♀, III 0·230–0·277, $\bar{x}$ 0·258 (3); V 0·160–0·180, $\bar{x}$ 0·170 (4); VI 0·371–0·394, $\bar{x}$ 0·387 (3). ♂, III 0·185–0·261, $\bar{x}$ 0·216 (3); V 0·138–0·163, $\bar{x}$ 0·146 (6); VI 0·312, 0·382, $\bar{x}$ 0·347 (2).

The interesting feature of this species is that although two setae on tergum VIII are very long in both sexes, in the female anterior setae are present on three to five (II or III to V or VI) pleurites and in the male one anterior seta usually occurs on one side only of one to three (IV–VI) pleurites. In this species therefore the male represents a somewhat intermediate condition in respect of these two characters, unlike *singularis* in which it is the female which represents the same condition.

Material examined.

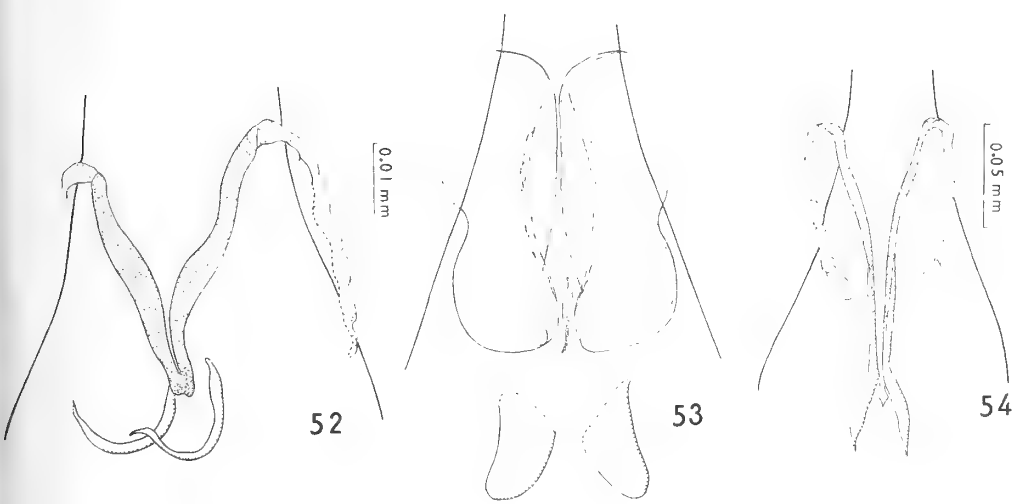
Holotype ♂, slide no. 753, from *Garrulax leucolophus patkaicus* Reichenow, Burma: Myitkyina, Kachin State, 22.xii.1944 (*H. S. Fuller*) (BMNH).

Figs 43–51. *Myrsidea* species, ♂ genitalia (genital sac omitted). 43, *erythrocephali*. 44, *assamensis* from type-host. 45, *singularis*. 46, *bhutanensis*. 47, *patkaiensis* from type-host; inwardly directed arm of basal apodeme stippled. 48, *manipurensis*. 49, *orientalis* from type-host. 50, *monilegeri* from type-host. 51, *sikkimensis*.

Paratypes. 3♂ (1 pharate), 2♀, with data as given for holotype.

Specimens from *G. chinensis lochmius* agree with *patkaiensis* in the male genitalia; in the female in the form of anterior terga, arrangement of marginal setae on sternites II and III and serrations of the vulval margin; in both sexes in the form of the hypopharynx and the very long two central setae on tergum VIII; the measurements, except of post-spiracular seta V (♀ 0·163–0·244, x̄ 0·191 (10); ♂ 0·153–0·173, x̄ 0·163 (10)) which tend to be longer; and most of the chaetotaxy. However, the following setae tend to be more numerous: in the male the metanotals (x̄ 7·66(3)), terminals on tergum IX (5 (4)) and the aster (4–5, x̄ 4·16 (6 asters)); in the female on tergum I 6–8, x̄ 7·57 (7)) and sternite II, the latter usually having anterior setae (each side 0–2, total 0–3, x̄ 1·20 (10)), this being an important difference; in both sexes the total number on terga II–VII (♀ 81–100, x̄ 88·66 (6); ♂ 66–73, x̄ 68·50 (4)) and on metasternal plate (♀ 8–13, x̄ 9·50 (8); ♂ 9–12, x̄ 10·50 (4)) average more. Setae which tend to be less in number are in the male the metapleural setae (x̄ 2·87 (8 sides)), those of the femoral brush (20–27, x̄ 23·37 (8 femora)), anterior ones on sternite III (0–1, x̄ 0·25 (4)), total number on sternite VII (21–27, x̄ 23·25 (4)) and on pleurites II–VII, the anterior ones being absent altogether.

These differences are inadequate for the taxonomic separation of either sex from *patkaiensis* s. str.; further, until the range of variation of *patkaiensis* is known from a larger series, the differences cannot be accepted as final. Owing to their resemblance therefore with *patkaiensis* s. str. in the more important taxonomical characters, besides several others, the specimens from *G. chinensis lochmius* have been included in *patkaiensis* s. l.



FIGS 52–54. *Myrsidea* species, ♂ genital sclerite. 52, *monilegeri* from type-host; outer arm of the loop on left-hand side, being distorted, has been omitted. 53, *singularis*, posterior processes have been shown closer to the sclerite proper. 54, *patkaiensis*, holotype. Scale between figs 52 and 53 applies to both.

Specimens from a subspecifically unidentified *G. chinensis* resemble *patkaiensis* s. str. in the taxonomically important characters and the chaetotaxy in general. However, 1 + 1 widely separated anterior setae are present on sternite II in the female. Also the number of setae in the aster (4 (6 asters)), on sternites III (anterior 0–1, x̄ 0·33) and VII (total number, x̄ 23·66) in the male, and of certain other parts (metanotum, ♂ x̄ 7·33; metasternal plate, ♀ 9, ♂ 8–11, x̄ 9; tergum VIII, ♀ 4 + 4; tergum IX, ♂, terminal 5–6, x̄ 5·33; genital region ♂ 14–21, x̄ 17; vulval marginal 6 + 5) is slightly different from *patkaiensis* s. str. On the whole these specimens show greater resemblance to *patkaiensis* than do *patkaiensis* s. l. from *G. chinensis lochmius*, and have also been included in *patkaiensis* s. l.

The data of this material, which is excluded from the type-series of *patkaiensis*, are listed below.

From *Garrulax chinensis lochmius* Deignan, THAILAND: Chiang Rai and Loei Provinces, 10 ♀, 4 ♂, 23.ii.1953, 20.ii., 25.ii., 21.iii.1955 (*R. E. Elbel*, or *R. E. Elbel* & *H. G. Deignan*) (EC and REC).

From *G. chinensis* Scopoli subsp. ?, THAILAND: Chiang Mai Province, 1♀, 3♂, 7.iv.1962 (*K. Thonglongya*), 16.xii.1965 (MAPS-3340) (EC and REC).

One male from *G. mitratus*, presumably subsp. *major* (Robinson & Kloss), slide no. 1967–400 (MALAYA: Gunong Benom, 21.iii.1967) (BMNH) has a fully developed hypopharynx, the same type of genital sclerite as in *patkaiensis* s. str. and two very long setae on tergum VIII. The number of setae on the metapleurite (3 + 3), on pleurites IV–VII, tibia I (6 + 4), in the femoral brush (23 + 22), on terga II–VII (total 59), tergum I (3 + 2) and VIII (2 + 2) and in the genital region (9 + 7) is approximately or the same as in *patkaiensis* s. str. But the number of terminal setae (5) on tergum IX is slightly more and of anterior setae (19) on sternite II (total 34), both central and marginal setae respectively on the following sternites (III, 0, 9; IV 2, 9; V, 4, 9; VI, 3, 10; VII, 4, 7) is somewhat less. As there is no doubt that this male is conspecific with *patkaiensis*, it has been included in *patkaiensis* s. l.

Myrsidea orientalis sp. n.

(Pl. 2, fig. 64; Text-figs 6, 15, 25, 40, 49)

Type-host: *Garrulax p. pectoralis* (Gould).

This form is distinguished from those species parasitic on *Garrulax* which have a reduced hypopharynx, by the details of the chaetotaxy, including the greater number of dorsal setae on tibia I and in the brush on femur III, and by the genital sclerite.

♀ and ♂. Hypopharynx greatly reduced. In the female tergum I very slightly but perceptibly enlarged and II normal; vulval margin medially smooth but laterally feebly to moderately serrated. The spermathecal duct opens in a bursa copulatrix (Text-fig. 40) which contains concretions resembling those present in the bursa of *Myrsidea* from *Turdoides*. In the male genitalia (Text-fig. 49), while the shape of the parameres is rather similar to those of *sikkimensis*, the inwardly directed arm of the basal apodeme is distinctive, as is the inner ventral arm of the genital sclerite. Proportions of head seta 10 relative to 11 variable. Apex of metasternal plate slightly or well produced (Text-fig. 15). Metanotal setae: ♀ (2), ♂ (5), 2 + 2. Metapleural setae: ♀ 3–4, x̄ 3·75 (4 sides); ♂ 2–3, x̄ 2·60 (10). Metasternal setae: ♀ 11, 14; ♂ 13–20, x̄ 15·80 (5). Outer dorsal setae of tibia I: ♀ 6–9, x̄ 7·25 (4 tibiae); ♂ 6–10, x̄ 8·44 (9). In this species

only is the average of tibial setae above 7 in the female and above 8 in the male (Text-fig. 25); in all others dealt with here there are fewer, the range in both sexes being 3–6 (except one female of *macraidoia* having 7 + 6 setae) and the average for the species below 6. Setae of femoral brush are also more numerous: ♀ 37–43, x̄ 39·25 (4 femora); ♂ 34–42, x̄ 36·77 (9).

ABDOMINAL CHAETOTAXY. Tergal setae: ♀ (Text-fig. 6) (2); I, 8, 14; II, 11, 18; III, 17, 18; IV, 16, 17; V, 17, 19; VI, 14, 17; VII, 12, 15; total of II–VII, 90, 101; VIII, 0 + 3, 2 + 2; IX, 2 long. ♂; I, 7–9, x̄ 8·20 (5); II, 10–12, x̄ 11 (4); III, 14–15, x̄ 14·40 (5); IV, 12–17, x̄ 14·60 (5); V, 12–14, x̄ 13·40 (5); VI, 13–14, x̄ 13·60 (5); VII, 10–11, x̄ 10·80 (5); total of II–VII, 75–81, x̄ 78·50 (4); VIII, 5–6, x̄ 5·60 (5); IX, terminal 4–5, x̄ 4·80 (5). In both sexes the two central setae on tergum VIII are very long, extending well beyond the posterior margin of tergum IX (one male having 3 + 3 setae has 1 + 2 very long setae). Pleural setae; in both sexes anterior setae normally present on pleurites II–VII. VIII: ♀, extra inner setae 1 + 1, ? + 2, moderately long; ♂ 1 + 1 (4), 0 + 1 (1), this is the only species in which extra inner setae are normally present in the male; outer and inner setae in both sexes approximately as in *assamensis*. Sternal setae. ♀ (2): II, anterior 7 (1) each side (total 14, those of the two sides well separated); the other ♀ (allotype) with 15 setae scattered almost all over the sternite; marginal 15, 16; total of anterior and marginal 29, 31; aster 5–6, x̄ 5·25 (4 asters). As the arrangement of the anterior setae on sternite II differs in the two females, the normal arrangement of this taxonomically important character remains unknown. However, in females from *G. pectoralis subfusus* considered to be conspecific there are 3–5 anterior setae each side, those of the two sides being separated by a large median gap. Central and marginal setae on sternites III–VII as follows: central anterior; III, absent; IV, 9, 12; V, 12, 15; VI, 13, 12; VII, 10, 13. Central marginal: III, 10, 12; IV, 13; V, 14, 12; VI, 11, 14; VII, 9, 10. Total of anterior and marginal setae: IV, 22, 25; V, 26, 27; VI, 24, 26; VII, 19, 23. Sternal, brushes, Table V. Total number on VII, 38, 42. Genital region 22; vulval marginal, 5 + 7, 7 + 5, those of the two sides separated by a rather narrow gap. Marginal setae on sternites II and III form a continuous row. ♂: II, anterior 25–28, x̄ 26·75; marginal 17–21, x̄ 18·25; total of anterior and marginal 42–49; aster 4–6, x̄ 5·10 (10 asters); III–VII or VIII, Tables III, VI; total number on VII, 33–42, x̄ 38 (5); genital region 14–18, x̄ 15·80 (5). Sometime 1 or 2 setae each side anterior to the aster resemble the setae of the aster in proportions (Text-fig. 29).

MEASUREMENTS of 2♀ and 3–5♂. *Length*: total, ♀ 1·90; ♂ 1·55–1·66, x̄ 1·62 (4). Head, ♀ 0·33, 0·35; ♂ 0·31–0·32, x̄ 0·316 (5). *Breadth*: preocular, ♀ 0·35, 0·36; ♂ 0·33–0·35, x̄ 0·34 (5). Temples, ♀ 0·55; ♂ 0·49–0·506, x̄ 0·502 (5). Pronotum, ♀ 0·35; ♂ 0·33–0·34, x̄ 0·334 (5). Metanotum, ♀ 0·535, 0·55; ♂ 0·42–0·45, x̄ 0·43 (5). Broadest tergite: ♀ 0·82, 0·835; ♂ 0·66–0·68, x̄ 0·665 (3). Length of post-spiracular setae: ♀, III 0·294–0·312, x̄ 0·300 (3); V 0·117–0·215, x̄ 0·191 (4); VI 0·459, 0·483, x̄ 0·471 (2). ♂, III 0·277–0·383, x̄ 0·327 (9); V 0·147–0·236, x̄ 0·187 (9); VI 0·371–0·471, x̄ 0·441 (9). While the range may overlap slightly with that of other species, the mean length of these setae is longer.

MATERIAL EXAMINED.

Holotype ♂, slide no. 19864, from *Garrulax p. pectoralis* (Gould), INDIA: Kangpokpi, Manipur, Assam State, 26.i.1952 (*R. Meinertzhagen*) (BMNH).

Paratypes. 1 ♀, with data as give for holotype and designated as allotype; 4 ♂ (1 dissected), 1 ♀, from *G. p. pectoralis*, BURMA: Myitkyina, Kachin State, 12.iii.1945 (*USA Typhus Commission*) (BMNH).

Specimens from *G. pectoralis subfusus* resemble *orientalis* in the form of anterior terga in the female, serrations of the vulval margin, the spermathecal duct and bursa copulatrix, the hypopharynx in both sexes and the male genitalia. While the chaetotaxy in general agrees well, some parts have more setae: the metanotum (♀ 5–11, x̄ 7·83 (6); ♂ 4–8, x̄ 5·75 (4)) and lateral brushes on sternites IV and V in both sexes, considerably more on tibia I (9–11, x̄ 9·73 (11 tibiae)) and the femoral

brush (39–53, x̄ 45·70 (10 femora)) in the female. The setae on the metasternal plate (♀ 8–12, x̄ 9·83 (6); ♂ 7–12, x̄ 9·50 (4)) and anterior ones on sternite II in the female (3–5 each side, total 6–9, x̄ 8·33 (6)) are fewer. Further, the female measures slightly larger and post-spiracular setae III, V and VI in this sex and V in the male are longer. While the anterior setae on sternite II in the female are arranged as in *assamensis* a comparison with *orientalis* is precluded as the normal arrangement in that form is unknown.

These differences are considered inadequate for separating these specimens from *orientalis* from the type-host, and they are therefore included in *orientalis* s. l.

MEASUREMENTS. Length of ♀: total 2·00–2·105, x̄ 2·03 (5). *Breadth* of ♀: preocular 0·365–0·39, x̄ 0·376 (5); pronotum 0·36–0·38, x̄ 0·37 (5); metanotum 0·55–0·57, x̄ 0·56 (5); broadest tergite 0·87–0·88, x̄ 0·878 (4). Length of post-spiracular setae: ♀, III 0·430–0·518, x̄ 0·475 (10); V 0·324–0·400, x̄ 0·366 (10); VI 0·459–0·512, x̄ 0·479 (9). ♂, V 0·230–0·383, x̄ 0·333 (6).

The data of this material, which is excluded from the type-series of *orientalis*, are as follows:

7 ♀, 4 ♂, from *Garrulax pectoralis subfusus* Kinnear, THAILAND: Chiang Rai, Kanchanaburi and Prachuap Khiri Khan Provinces, 16.xi., 21.xii.1952, 3.iii.1953 (*R. E. Elbel & H. G. Deignan*) (EC and REC).

Myrsidea macraidoia sp. n.

(Pl. 1, fig. 58; Text-figs 7, 8, 16, 31)

Type-host: *Garrulax a. albogularis* (Gould).

This form, the largest of the species dealt with here, is distinguished from those species from *Garrulax* in which the hypopharynx is reduced by the details of the chaetotaxy, particularly the large number of setae in the genital region, and by the male genitalia.

♀ and ♂. Hypopharynx considerably reduced. In the female tergum I normal, vulval margin not serrated. Microtrichia of the genital chamber as in *M. abidae* (see Clay, 1966: fig. 24) but slightly longer; in the spermatheca only the long duct is visible, with a typical calyx (as shown in fig. 2 in Clay, 1968) at its anterior end. Male genitalia and the distinctive genital sclerite large, hence the name of the species. Head seta 10 extends well beyond the middle of seta 11 but falls short of the tip of the latter, being relatively longer than in most species (Text-fig. 9). Apex of metasternal plate considerably elongated as in female *patkaiensis*. Metanotal setae: ♀ 8–10 (8); ♂ 4–8, x̄ 6·25 (4). Metapleural setae: ♀ 4–5, x̄ 4·63 (22 sides); ♂ 3–5, x̄ 4·25 (12). Metasternal setae: ♀ 8–10 (10); ♂ 8–9 (4). Outer dorsal setae of tibia I: ♀ 5 + 5 (7), 7 + 6 (1), x̄ 5·16 (18 tibiae); ♂ 4–5, x̄ 4·71 (8). Setae of femoral brush: ♀ 20–32, x̄ 27·35 (20 femora); ♂ 18–33, x̄ 26 (11).

ABDOMINAL CHAETOTAXY. Tergal setae (Text-figs 7, 8): ♀; I, 12–16, x̄ 13·85 (7); II, 16–20, x̄ 17·33 (6); III, 16–20, x̄ 17·57 (7); IV, 15–21, x̄ 18·14 (7); V, 18–21, x̄ 19 (7); VI, 16–23, x̄ 19·11 (9); VII, 18–21, x̄ 19·33 (9); total of II–VII, 103–119, x̄ 108·66 (6); VIII, 13–16, x̄ 14·88 (9); IX, each side 3–6 (1 may be removed from the others and close to the lateral, very long and stout seta), total 8–11, x̄ 9·29 (9). ♂; I, 9–11, x̄ 10 (5); II, 12–14, x̄ 13·66 (6); III, 15–17, x̄ 15·80 (5); IV, 14–18, x̄ 16·33 (6); V, 17–20, x̄ 18 (6); VI, 16–19, x̄ 17·40 (5); VII, 15–19, x̄ 16·20 (5); total of II–VII, 94–103, x̄ 98·25 (4); VIII, 12–13, x̄ 12·40 (5); IX, terminal 5–6, x̄ 5·80 (5). Tergum VIII in both sexes with 1 + 1 very long setae, extending far beyond the posterior margin of tergum IX. Pleural setae: anterior setae present on pleurites II–VI or VII in the

female and II–VI in the male. VIII: ♀, extra inner setae may be present on one or both sides, moderately long to long (total 3 (1), 2 (4), 1 (4), 0 (2)); outer and inner setae in both sexes as in Text-fig. 16. Sternal setae. ♀: II, anterior 17–20, $\bar{x}$ 18·77 (9), present almost all over the sternite; marginal 16–19, $\bar{x}$ 17·44 (9); total of anterior and marginal 34–39; aster 4–6, $\bar{x}$ 4·27 (22 asters); III–VII, Tables I, V; total number on VII, 45–50, $\bar{x}$ 48·33 (11); genital region 39–50, $\bar{x}$ 44·10 (10); vulval marginal 19–27, $\bar{x}$ 24·20 (10), forming a continuous row. ♂: II, anterior 15–19, $\bar{x}$ 17·80 (5); marginal 16–18, $\bar{x}$ 16·40 (5); total of anterior and marginal 31–37; aster 4–5, $\bar{x}$ 4·41 (12); III–VII or VIII, Tables III, VI; total number on VII, 41–45, $\bar{x}$ 42·33 (6); genital region 30–35, $\bar{x}$ 32·20 (5). This species has the most numerous setae in the genital region (Text-fig. 31) of both sexes and on the vulval margin of the female.

MEASUREMENTS. *Length*: total, ♀ 2·04–2·06, $\bar{x}$ 2·15 (7); ♂ 1·92–2·18, $\bar{x}$ 2·06 (4). Head, ♀ 0·35–0·38, $\bar{x}$ 0·364 (6); ♂ 0·347–0·365, $\bar{x}$ 0·352 (6). *Breadth*: preocular, ♀ 0·38–0·41, $\bar{x}$ 0·40 (6); ♂ 0·365–0·38, $\bar{x}$ 0·37 (6). Temples, ♀ 0·56–0·59, $\bar{x}$ 0·58 (6); ♂ 0·535–0·55, $\bar{x}$ 0·54 (6). Pronotum, ♀ 0·37–0·41, $\bar{x}$ 0·39 (6); ♂ 0·365–0·371, $\bar{x}$ 0·367 (6). Metanotum, ♀ 0·50–0·535, $\bar{x}$ 0·52 (6); ♂ 0·42–0·47, $\bar{x}$ 0·45 (6). Broadest tergite: ♀ 0·76–0·835, $\bar{x}$ 0·80 (6); ♂ 0·65–0·68, $\bar{x}$ 0·66 (4). Length of post-spiracular setae: ♀, III 0·230–0·274, $\bar{x}$ 0·255 (7); V 0·160–0·195, $\bar{x}$ 0·180 (10); VI 0·353–0·481, $\bar{x}$ 0·429 (8). ♂, III 0·072–0·123, $\bar{x}$ 0·102 (8); V 0·044–0·070, $\bar{x}$ 0·054 (7); VI 0·353–0·471, $\bar{x}$ 0·400 (5). The striking feature is the short size of post-spiracular seta V in the male.

MATERIAL EXAMINED.

Holotype ♂, slide no. 15128*a*, from *Garrulax a. albogularis* (Gould), INDIA: Punjab, x.1943 (*R. Meinertzhagen*) (BMNH).

Paratypes. 3 ♂ (1 dissected), 8 ♀, with data as given for holotype; 2 ♂ (1 dissected), 3 ♀, from *G. a. albogularis*, NEPAL: x. and xii.1935 (*R. Meinertzhagen* 4533, 4861) (BMNH).

Two females from *G. albogularis whistleri* Baker (SIKKIM: Lachung, 17.ii.1952 (*R. Meinertzhagen*, 19949 (BMNH)) resemble *macraidoia* in the degree of reduction of the hypopharynx, the form of anterior abdominal terga, but neither the spermathecal duct nor a bursa are visible. The measurements fall within the range of that species, as also the number of setae, except for that on certain parts which differs slightly as follows: Tergal (2); I, 11; II-VII, total 101, 104; IX, 12, 14 (fewer on I–VII, more on IX); anterior setae on sternite III, 6. However, they differ markedly in having two very long setae each side of tergum VIII instead of one as in *macraidoia*. While this character separates these particular females from *macradoia*, a large series is necessary to determine the constancy of this difference in populations from these two subspecies of *G. albogularis*. Further, a close and satisfactory comparison is precluded as no male is available from *G. a. whistleri*. With these limitations and because of otherwise close resemblance with *macraidoia*, it has been considered more satisfactory to include these two females in *macradoia* s. l., but not in the type-series.

KEY TO THE SPECIES OF *MYRSIDEA* PARASITIC ON *GARRULAX* AND *POMATORHINUS*

In the key to the males preference has been given to non-sexual characters, those of the male genitalia being used more for confirmation of identification. The placing of *M. sehri* Ansari proved difficult owing to the poor state of the type-specimens and the lack of the range of variation of key characters. For taxa parasitizing more than one host-species or subspecies, the range of variation of the specimens from all the hosts has been given, not only of those from the type-host on which the taxon s. str. is based.

Females

1 Hypopharynx fully developed (as in Pl. 1, fig. 55) 2

– Hypopharynx reduced to varying degrees (Pl. 1, figs 56, 57) 5

2 (1) Pleurites II–VI without anterior setae; longest tergal seta on VIII may just cross posterior margin of tergum IX; anterior setae on sternite II present centrally 3

– Pleurites IV and V always, II, III and VI usually with anterior setae; 2 tergal setae on VIII extend well beyond posterior margin of tergum IX; anterior setae on sternite II either absent or present only laterally (Text-figs 22, 23) 4

3 (2) Tergum I considerably enlarged and II slightly modified; the 2 central setae on I finer and shorter than the outer ones (Text-fig. 3). ***manipurensis*** sp. n. (p. 377)

– Tergum I very slightly enlarged and II normal; the 2 central setae on I markedly longer than the 2 outer ones (as in Text-fig. 1). ***duplicata*** sp. n. (p. 379)

4 (2) 12–13 ($\bar{x}$ 12·66) setae on tergum I; 11–14 ($\bar{x}$ 12·66) setae on metanotum and 9–10 ($\bar{x}$ 9·33) on tergum VIII; on sternite II 4 or more ($\bar{x}$ over 6) anterior setae (Text-fig. 22) . . . . ***bhutanensis*** sp. n. (p. 385)

– 5–8 ($\bar{x}$ under 8) setae on tergum I; 8–9 ($\bar{x}$ under 9) setae on metanotum and 4–6 ($\bar{x}$ under 6) on tergum VIII; on sternite II 0–3 ($\bar{x}$ under 3) anterior setae (Text-fig. 23) . . . . ***patkaiensis*** sp. n. (p. 394)

5 (1) Metanotum enlarged with 16–19 marginal setae; pleurite I with 9–11 long marginal setae forming a frill (Text-fig. 4) . . ***singularis*** sp. n. (p. 382)

– Metanotum normal having under 11 marginal setae; marginal setae on pleurite I short and spiniform (Text-fig. 1) 6

6 (5) Pleurites II–VI without anterior setae; the more central setae on tergum VIII not extending beyond posterior margin of tergum IX (Text-fig. 1) . . 7

– Pleurites II or III–VI with anterior setae; 2 tergal setae on VIII extending well beyond posterior margin of tergum IX (Text-figs 5–7) 9

7 (6) Terga I and II normal . . . . ***sehri*** Ansari (p. 374)

– Tergum I slightly or considerably enlarged, II normal or slightly modified 8

8 (7) The 2 central setae on tergum I long and markedly longer than the 2 lateral ones (Text-fig. 1) . . . . ***erythrocephali*** sp. n. (p. 375)

– The 2 central setae on tergum I short and fine and the 2 lateral ones slightly longer but considerably stouter (as in Text-fig. 3). ***thailandensis*** sp. n. (p. 382)

9 (6) Tergum IX with 2 marginal setae (Text-fig. 6); 37–53 ($\bar{x}$ above 39) setae in femoral brush and 6–11 ($\bar{x}$ above 7) dorsal setae on tibia I. ***orientalis*** sp. n. (p. 398)

– Tergum IX with 4–13 ($\bar{x}$ 5–10) marginal setae (Text-figs 5, 7); under 35 ($\bar{x}$ under 30) setae in femoral brush and normally 4–6 ($\bar{x}$ under 5·25) dorsal setae on tibia I 10

10 (9) Tergum I with 4 ($\bar{x}$ under 5) setae (Text-fig. 5). On sternite II 3–9 setae present each side (Text-fig. 24) separated by a large gap (total 6–16) ***assamensis*** sp. n. (p. 390)

– Tergum I with 7–16 ($\bar{x}$ above 8) setae 11

11 (10) 5–6 setae on tergum VIII and 13 in the genital region (Text-fig. 27). On sternite II 2–4 anterior setae each side (Text-fig. 30) separated by a gap (total 6) ***monilegeri*** sp. n.? (p. 388)

– 13–16 setae on tergum VIII (Text-fig. 7) and 39–50 in the genital region. On sternite II 17–20 anterior, centrally located setae . ***macraidoia*** sp. n. (p. 400)

Males

1 Hypopharynx fully developed (Pl. 1, fig. 55) 2

– Hypopharynx reduced to varying degrees (as in Pl. 1, figs 56, 57) . . 5

2 (1) Tergum I with 4 setae; longest tergal seta on VIII may just cross posterior margin of tergum IX 3

– Tergum I with 5–13 setae; the 2 central setae on tergum VIII normally very long, extending well beyond posterior margin of tergum IX (Text-fig. 20) 4

3 (2) Inwardly directed arm of basal apodeme short (Text-fig. 48). ***manipurensis*** sp. n. (p. 377)

– Inwardly directed arm of basal apodeme significantly larger (as in Text-fig. 43). ***duplicata*** sp. n. (p. 379)

4 (2) On tergum I 9–13 ($\bar{x}$ 11·25) (Text-fig. 18) and on VIII 8–9 ($\bar{x}$ 8·25) setae; genital sclerite as in Pl. 2, fig. 62 . . . . ***bhutanensis*** sp. n. (p. 385)

– On tergum I 5–8 ($\bar{x}$ under 7) setae and on VIII 4–6 ($\bar{x}$ under 5) setae (Text-fig. 20); genital sclerite as in Text-fig. 54 . . . ***patkaiensis*** sp. n. (p. 394)

5 (1) Pleurites II–VII without anterior setae (Text-fig. 2); the more central setae on tergum VIII may just cross posterior margin of tergum IX (Text-fig. 19) 6

– Pleurite V always, II–IV and VI usually and, VII occasionally with anterior setae (Text-fig. 28); 2 tergal setae on VIII extend well beyond posterior margin of tergum IX (Text-fig. 8) 9

6 (5) 6–7 ($\bar{x}$ 6·25) setae on tergum I, 8–9 ($\bar{x}$ 8·25) metanotal setae (Text-fig. 17); genital sclerite as in Text-fig. 53 . . . . ***singularis*** sp. n. (p. 382)

– 4 setae on tergum I, 4–5 ($\bar{x}$ under 5) metanotal setae; genital sclerite not as above 7

7 (6) Sternites IV–VI without central anterior setae; genital sclerite as in Pl. 2, fig. 61. ***sikkimensis*** sp. n. (p. 382)

– Sternites IV–VI with central anterior setae (Text-fig. 2); genital sclerite not as above 8

8 (7) 7 anterior setae on sternite II (Text-fig. 21); genital sclerite as in Pl. 2, fig. 59. ***sehri*** Ansari (p. 374)

– 10–15 anterior setae on sternite II (Text-fig. 2); genital sclerite as in Pl. 2, fig. 60. ***erythrocephali*** sp. n. (p. 375)

9 (5) 12–13 ($\bar{x}$ 12·40) setae on tergum VIII and 30–35 ($\bar{x}$ 32·20) in the genital region (Text-figs 8, 31); genitalia as in Pl. 1, fig. 58 . . ***macraidoia*** sp. n. (p. 400)

– 4–7 ($\bar{x}$ under 7) setae on tergum VIII and 10–20 ($\bar{x}$ under 20) in the genital region (Text-fig. 26); genitalia not as above 10

10 (9) 34–42 ($\bar{x}$ above 36) setae in the femoral brush and 6–11 ($\bar{x}$ above 8) dorsal setae on tibia I (Text-fig. 25); genital sclerite as in Pl. 2, fig. 64. ***orientalis*** sp. n. (p. 398)

– Under 31 ($\bar{x}$ under 28) setae in the femoral brush and 4–6 ($\bar{x}$ under 5·50) dorsal setae on tibia I; genital sclerite not as above 11

11 (10) Genitalia and genital sclerite as in Text-figs 50, 52 . ***monilegeri*** sp. n. (p. 388)

– Genitalia and genital sclerite as in Text-fig. 44 and Pl. 2, fig. 63. ***assamensis*** sp. n. (p. 390)

HOST-PARASITE LIST

The arrangement of hosts is according to Deignan (1964). Type-hosts are marked with an asterisk (*).

Host	*Myrsidea* Species	*Page*
Pomatorhinus		
P. erythrogenys	*M.* sp.	377
**P. schisticeps*	*M. duplicata* sp. n.	379
P. ferruginosus	*M.* sp.	381

Host	*Myrsidea* Species (*cont*).	Page
Garrulax		
G. albogularis whistleri	*M. macraidoia* sp. n., s.l.	400
**G. a. albogularis*	*M. macraidoia* sp. n.	400
G. leucophus	*M. assamensis* sp. n., s.l.	390
**G. l. leucolophus*	*M. assamensis* sp. n.	390
**G. leucolophus patkaicus*	*M. patkaiensis* sp. n.	394
G. leucolophus belangeri	*M. assamensis* sp. n., s.l.	390
G. leucolophus diardi	*M. assamensis* sp. n., s.l.	390
**G. monileger fuscatus*	*M. monilegeri* sp. n.	388
G. monileger schauenseei	*M. monilegeri* sp. n. ?	388
**G. p. pectoralis*	*M. orientalis* sp. n.	398
G. pectoralis subfusus	*M. orientalis* sp. n., s.l.	398
**G. striatus sikkimensis*	*M. sikkimensis* sp. n.	382
G. chinensis	*M. patkaiensis* sp. n., s.l.	394
G. chinensis lochmius	*M. patkaiensis* sp. n., s.l.	394
G. mitratus (? *major*)	*M. patkaiensis* sp. n., s.l.	394
**G. ruficollis*	*M. bhutanensis* sp. n.	384
* *G. merulinus*	*M. thailandensis* sp. n.	381
**G. l. lineatus*	*M. sehri* Ansari, 1951	374
**G. squamatus*	*M. manipurensis* sp. n.	377
**G. s. subunicolor*	*M. singularis* sp. n.	382
**G. erythrocephalus*	*M. erythrocephali* sp. n.	375

DISCUSSION

In *Myrsidea* parasitic on the Turdinae and on *Turdoides* (Clay, 1966; Tandan & Clay, 1971) divisions into species-groups can be based on both non-sexual and sexual characters, the former enabling the grouping together of both sexes. In the 13 species of *Myrsidea* from *Garrulax* and *Pomatorhinus* most of the non-sexual characters are similar, making the grouping together of the sexes not feasible. However, the sexual characters do enable groups based on different sexes to be formed. The females are divisible into two groups, A and B as listed below, according to the nature of the structure associated with the opening of the spermathecal duct, while the males of some of the species can be arranged according to the genital sclerite. Two species, *sehri*, in which the female character has not been seen satisfactorily, and *patkaiensis*, in which it has not been seen at all, have been assigned their respective groups on the basis of the resemblance of the male genital sclerite; *macraidoia*, in which the bursa has also not been seen, is included in group B on the presumption that it has a thin-walled, hence not easily visible, bursa copulatrix. As the available material is considered insufficient to decide which grouping, whether based on female or male genitalia, would be more satisfactory, recognition of species-groups has been deferred until *Myrsidea* from more taxa of *Garrulax* and *Pomatorhinus* is available.

In the *Check-List of Birds of the World* (volume **10,** 1964), Deignan included 44 species in *Garrulax* and 8 in *Pomatorhinus*, most of the species of the former and all of the latter genus being polytypic. As specimens of *Myrsidea* have been seen from only 13 species of *Garrulax* (two monotypic and 11 polytypic) and three species of *Pomatorhinus*, the amount of material available for host-parasite deductions is comparatively small. No useful deductions on the relationships of the hosts can therefore be made from the two groups into which the females of the parasite species have been divided, but the relationships of the species within the groups are certainly informative. These affinities have been based on the form of the male genital sclerite as this structure, as in other groups of *Myrsidea* (see also Clay, 1962: 194), seems to show the most reliable characters indicative of the affinities of the species. According to this character: (1) the species parasitic on *Garrulax erythrocephalus* (*Myrsidea erythrocephali*), *Pomatorhinus erythrogenys* (*Myrsidea* sp.), *G. squamatus* (*M. manipurensis*), *P. schisticeps* (*M. duplicata*) and *P. ferruginosus* (*Myrsidea* sp.) are closer to each other than to those parasitic on other species of *Garrulax* and (2) the species living on *G. leucolophus patkaicus* (*M. patkaiensis*), also parasitic on *G. chinensis lochmius* and *G. mitratus* (? *major*), is specifically distinct from that living on three other conspecific subspecies, *G. l. leucolophus*, *G. l. belangeri* and *G. l. diardi*. Since *Myrsidea* from different subspecies is frequently specifically distinct, less frequently even strikingly enough to belong to different species-groups, all that can be inferred from these affinities is the possibility that the particular subspecies of *G. erythrocephalus*, *P. erythrogenys*, *P. schisticeps* and *P. ferruginosus*, as also the monotypic *G. squamatus*, from which the specimens came, may be more closely related to each other than hitherto suspected, and that *G. l. patkaicus* may be closer to *G. chinensis lochmius* and *G. mitratus* (? *major*) than to *G. l. leucolophus*, *G. leucolophus belangeri* and *G. leucolophus diardi*.

	Myrsidea SPECIES	HOST SPECIES
	M. sehri Ansari, 1951	*Garrulax l. lineatus*
	M. erythrocephali sp. n.	*Garrulax erythrocephalus*
	M. sp.	*Pomatorhinus erythrogenys*
	M. manipurensis sp. n.	*Garrulax squamatus*
A	*M. duplicata* sp. n.	*Pomatorhinus schisticeps*
	M. sp.	*Pomatorhinus ferruginosus*
	M. thailandensis sp. n.	*Garrulax merulinus*
	M. sikkimensis sp. n.	*Garrulax striatus sikkimensis*
	M. singularis sp. n.	*Garrulax s. subunicolor*
	M. bhutanensis sp. n.	*Garrulax ruficollis*

B	*M. monilegeri* sp. n.	*Garrulax monileger fuscatus*
		Garrulax monileger schauenseei
	M. assamensis sp. n.	*Garrulax l. leucolophus*
		Garrulax l. belangeri
		Garrulax l. diardi
	M. patkaiensis sp. n.	*Garrulax leucolophus patkaicus*
		Garrulax chinensis lochmius
		Garrulax mitratus (? *major*)
	M orientalis sp. n	*Garrulax p. pectoralis*
		Garrulax pectoralis subfusus
	M. macraidoia sp. n.	*Garrulax a. albogularis*
		Garrulax albogularis whistleri

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Table I

Central setae of sternites, ♀

		erythrocephali		*assamensis*		*singularis*		*macraidoia*	
		Range	Mean	Range	Mean (4)	Range	Mean (5)	Range	Mean (6)
III	Anterior	Absent*		Absent		Absent		0–3	0·9
	Marginal	12–15	13·6 (7)	7–9	7·8	14–15	14·8	12–17	15·4
	Total							13–19	16·4 (11)
IV	Anterior	5–9	7·0	3–6	4·2	0–4	2·6	13–18	15·3
	Marginal	10–15	12·8	9–11	10·0	13–15	14·2	13–16	14·3
	Total	16–23	19·8 (6)	12–17	14·2	15–19	16·8	26–32	29·7
V	Anterior	6–10	7·8	4–7	5·5	4–7	4·8	14–18	15·8
	Marginal	10–13	11·8	9–11	10·5	13–14	13·2	12–15	13·8
	Total	18–23	19·7 (6)	14–19	16·0	17–21	18·0	28–32	29·7
VI	Anterior	5–7	6·2	5–9	6·8	5–10	7·6	15–19	16·8
	Marginal	10–12	11·0	9–10	9·25	11–14	13·2	12–14	13·2
	Total	16–18	17·2 (5)	14–19	16·0	17–24	20·8	27–33	30·0
VII	Anterior	5–11	7·4	4–9	6·8	15–18	16·2	15–20	18·0
	Marginal	5–7	6·2	7–8	7·2	7–10	9·0	10–13	11·7
	Total	10–18	13·6 (5)	12–16	14·0	23–28	25·2	27–33	29·7

* One seta in 1 out of 7.

Table II

Central setae of sternites, ♂

		erythrocephali		*manipurensis*		*singularis*		*bhutanensis*	
		Range	Mean	Range	Mean (4)	Range	Mean (4)	Range	Mean
III	Anterior	Absent*		Absent		0–1	0·5	2–5	3·2
	Marginal	10–13	11·5 (8)	9–10	9·5	12–17	15·0	12–14	12·8
	Total					12–18	15·5	14–19	16·0 (4)
IV	Anterior	4–7	5·2	2–5	3·5	2–4	2·8	7–9	8·0
	Marginal	10–12	11·2	9–11	10·2	11–14	12·2	12–13	12·3
	Total	14–18	16·4 (5)	13–15	13·8	13–18	15·0	19–22	20·3 (3)
V	Anterior	2–7	5·4	3–5	3·5	4–5	4·2	7–10	8
	Marginal	10–12	11·0	8–11	9·8	12–14	12·8	11–13	12·3
	Total	13–18	16·4 (5)	11–16	13·2	16–18	17·0	18–23	20·3 (3)
VI	Anterior	2–6	4·4	4–5	4·2	5–8	6·2	7–8	7·7
	Marginal	8–11	9·4	8–10	9·0	10–11	10·5	10–11	10·3
	Total	10–15	13·8 (5)	12–14	13·2	15–18	16·8	17–19	18·0 (3)
VII	Anterior	3–7	5·0	4–7	5·0	6–10	8·5	7–9	8·0
	Marginal	7–10	8·6	8–9	8·2	7–11	9·2	9–11	10·0
	Total	10–16	13·6 (5)	12–15	13·2	15–20	17·8	17–20	18·0 (3)
VIII	Anterior	2–5	3·8	3–5	3·8	4–8	6·5	3–6	4·3
	Marginal	6–8	6·4	6–7	6·2	6–10	8·2	7–9	8·0
	Total	9–11	10·1 (8)	9–11	10·0	12–17	14·8	10–14	12·3 (3)

* One seta in 1 out of 8.

Table III

Central setae of sternites, ♂

		assamensis		*patkainesis*		*orientalis*		*macraidoia*	
		Range	Mean (4)	Range	Mean	Range	Mean (5)	Range	Mean
III	Anterior	4–7	5·2	0–3	1·7	0–3	0·6	3–5*	3·6
	Marginal	11–14	12·5	10–11	10·7	14–16	15·2	12–16	13·8
	Total	15–19	17·8	10–14	12·3 (3)	15–17	15·8	15–20	17·4 (5)
IV	Anterior	7–11	8·8	6, 4		5–9	7·4	10–13	11·8
	Marginal	12–13	12·5	11, 10		11–15	13·6	12–14	12·8
	Total	20–23	21·2	17, 14	15·5 (2)	19–23	21·0	23–26	24·7 (6)
V	Anterior	6–10	7·8	7, 6		6–12	9·0	9–15	12·2
	Marginal	10–13	11·8	10, 8		12–15	13·4	11–12	11·5
	Total	17–23	19·5	17, 14	15·5 (2)	19–27	22·4	20–27	23·7 (6)
VI	Anterior	6–10	7·8	6, 7		7–10	8·6	9–12	10·8
	Marginal	11–12	11·5	9, 9		10–14	12·0	10–12	11·2
	Total	18–21	19·2	15, 16	15·5 (2)	18–24	20·6	19–24	22·0 (6)
VII	Anterior	7–9	8·0	9, 5		6–12	9·2	12–15	13·8
	Marginal	7–10	9·0	8, 8		10–12	11·2	11–13	11·5
	Total	15–19	17·0	17, 13	15·0 (2)	16–24	20·4	24–27	25·3 (6)
VIII	Anterior	4–6	4·8	2–6	4·0	3–8	5·6	14–18	15·6
	Marginal	7–9	8·0	6–7	6·7	8–10	9·0	9–11	10·6
	Total	11–13	12·8	9–13	10·7 (3)	12–17	14·6	25–27	26·2 (5)

* Absent in 1 out of 6.

TABLE IV

Setae in lateral sternal brushes, ♀

		erythrocephali		*manipurensis*		*bhutanensis*		*singularis*	
		Range	Mean	Range	Mean (4)	Range	Mean	Range	Mean (10)
III	Anterior	0–1	0·5	0–1	0·2	4–7	5·2	2–5	3·5
	Marginal	2–4	3·1	1–4	2·2	3–5	4·7	4–5	4·3
	Total	2–5	3·6 (14)	1–4	2·5	7–12	9·8 (6)	7–10	7·8
IV	Anterior	7–12	9·8	5–6	5·2	10–12	11·0	6–11	9·0
	Marginal	5–7	5·8	5–6	5·8	6–8	7·0	6–7	6·3
	Total	14–17	15·6 (14)	10–12	11·0	17–19	18·0 (4)	13–17	15·3
V	Anterior	9–13	11·0	6–10	7·5	15–17	16·2	9–11	10·1
	Marginal	6–8	6·6	6	6·0	7	7·0	6–7	6·3
	Total	16–20	17·6 (12)	12–16	13·5	22–24	23·2 (4)	15–18	16·4
VI	Anterior	9–12	9·9	5–8	7·0	13–16	14·8	8–13	9·8
	Marginal	5–7	5·8	6	6·0	6–7	6·5	5–6	5·6
	Total	14–18	15·7 (10)	11–14	13·0	19–23	21·2 (4)	14–19	15·4
VII	Anterior	4–7	5·7	4–6	4·8	4–6	5·2	3–7	4·8
	Marginal	2–3	2·6	2–4	3·0	2–3	2·2	2–4	2·9
	Total	7–10	8·3 (10)	7–9	7·8	6–9	7·5 (4)	6–10	7·7

Figures in brackets denote sides.

Table V

Setae in lateral sternal brushes, ♀

		monilegeri		*assamensis*		*patkaiensis*		*orientalis*		*macraidoia*	
		Range	Mean (4)	Range	Mean (8)	Range	Mean (4)	Range	Mean (4)	Range	Mean (12)
III	Anterior	1–3	2·0	2–4	3·0	1	1·0	5–7	5·8	3–5	4·1
	Marginal	4–5	4·5	4–5	4·4	3–4	3·2	4–5	4·5	4–6	5·0
	Total	5–8	6·5	7–8	7·4	4–5	4·2	9–11	10·2	8–11	9·1
IV	Anterior	10–13	12·2	5–9	6·5	7–8	7·5	12–16	14·0	12–16	14·4
	Marginal	6–7	6·5	5–6	5·9	6–7	6·2	7–8	7·2	7–8	7·4
	Total	16–20	18·8	11–15	12·4	13–15	13·8	19–23	21·2	20–23	21·8
V	Anterior	11–17	13·8	8–11	9·2	11–13	12·2	17–21	18·2	15–18	16·4
	Marginal	7–8	7·2	6–7	6·4	7	7·0	7–9	8·0	7–9	7·9
	Total	18–24	21·0	14–17	15·6	18–20	19·2	25–28	26·2	23–26	24·3
VI	Anterior	12–14	13·0	6–11	8·1	8–11	9·5	15–19	16·8	9–15	11·8
	Marginal	6–7	6·2	5–7	5·9	5–6	5·8	6–8	7·5	6–7	6·4
	Total	18–20	19·2	12–18	14·0	14–17	15·2	23–27	24·2	15–22	18·2
VII	Anterior	3–6	3·8	2–4	2·8	1–3	2·0	6–7	6·2	5–8	6·1
	Marginal	2–3	2·8	1–3	2·2	2	2·0	3–4	3·2	3–4	3·2
	Total	6–8	6·5	4–6	5·0	3–5	4·0	9–10	9·5	8–12	9·3

Figures in brackets denote sides.

Table VI

Setae in lateral sternal brushes, ♂

		erythrocephali		*manipurensis*		*sikkimensis*		*bhutanensis*		*singularis*	
		Range	Mean	Range	Mean (8)	Range	Mean (4)	Range	Mean	Range	Mean (8)
III	Anterior	0–1	0·4	Absent		1–2	1·5	2–5	3·5	1–3	2·0
	Marginal	2–4	3·0	3–4	3·1	2–5	3·0	4–6	4·8	3–4	3·6
	Total	3–5	3·4 (16)			3–6	4·5	6–10	8·2 (8)	5–7	5·6
IV	Anterior	5–8	6·2	2–5	3·4	3–5	4·0	8–10	8·8	4–6	4·8
	Marginal	4–7	5·8	5	5·0	5–6	5·5	5–7	6·5	5–6	5·5
	Total	10–14	12·0 (10)	7–10	8·4	9–10	9·5	13–17	15·3 (6)	9–11	10·2
V	Anterior	7–10	8·1	5–7	5·5	6–9	7·5	12–17	13·5	4–6	5·0
	Marginal	5–7	6·2	5–6	5·6	5–6	5·2	6–8	7·0	5–6	5·5
	Total	13–16	14·3 (10)	11–12	11·1	11–14	12·8	18–24	20·5 (6)	9–12	10·5
VI	Anterior	5–7	6·4	5	5·0	6–7	6·2	12–14	13·0	4–6	4·6
	Marginal	5–6	5·2	4–5	4·9	5	5·0	5–7	6·2	5–6	5·2
	Total	10–13	11·6 (10)	9–10	9·9	11–12	11·2	18–21	19·2 (6)	9–11	9·9
VII	Anterior	2–4	2·8	2–3	2·1	1–4	2·8	4–6	5·0	2–4	3·0
	Marginal	2–3	2·9	3	3·0	2–3	2·2	3–4	3·5	2–4	3·2
	Total	5–7	5·7 (10)	5–6	5·1	3–6	5·0	8–10	8·5 (6)	6–7	6·2

Figures in brackets denote sides.

TABLE VII

Setae in lateral sternal brushes, ♂

		assamensis		*patkaiensis*		*orientalis*		*macraidoia*	
		Range	Mean (8)	Range	Mean	Range	Mean (10)	Range	Mean (12)
III	Anterior	2–4	3·0	0–3	1·5	3–4	3·5	4–7	5·4
	Marginal	4–5	4·4	4	4·0	4–6	5·2	4–7	5·4
	Total	6–8	7·4	4–7	5·5 (6)	7–10	8·7	9–13	10·8
IV	Anterior	5–8	6·6	6–8	7·0	10–13	11·4	10–17	14·3
	Marginal	6–7	6·4	5–6	5·7	6–8	7·1	6–8	7·1
	Total	12–15	13·0	12–14	12·7 (4)	17–20	18·5	17–25	21·4
V	Anterior	5–10	8·0	8–11	9·6	13–15	14·9	11–19	15·9
	Marginal	6–7	6·5	6–7	6·6	6–9	7·9	7–8	7·3
	Total	11–16	14·5	14–18	16·2 (5)	21–24	22·8	18–26	23·2
VI	Anterior	5–8	7·4	8–10	9·0	12–13	13·7	9–15	12·1
	Marginal	5–6	5·6	5–6	5·8	6–8	6·9	5–8	6·2
	Total	11–14	13	14–16	14·8 (6)	19–23	20·6	15–21	18·3
VII	Anterior	1–4	2·5	2–3	2·8	4–6	5·4	3–7	5·2
	Marginal	3–4	3·4	3	3·0	3–4	3·4	3–9	3·2
	Total	4–8	5·9	5–6	5·8 (6)	7–10	8·8	7–10	8·5

Figures in brackets denote sides.

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Myrsidea species

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PLATE 1

Myrsidea species

FIG. 55. *M. manipurensis*, ♂ head.
FIG. 56. *M. singularis*, ♀ head.
FIG. 57. *M. assamensis* from *G. leucolophus diardi*, ♀ head.
FIG. 58. *M. macraidoia* from type-host, ♂ genitalia.

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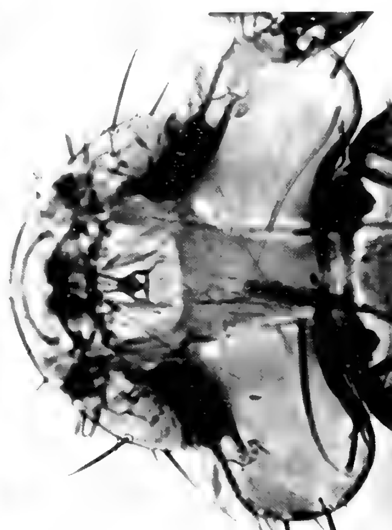

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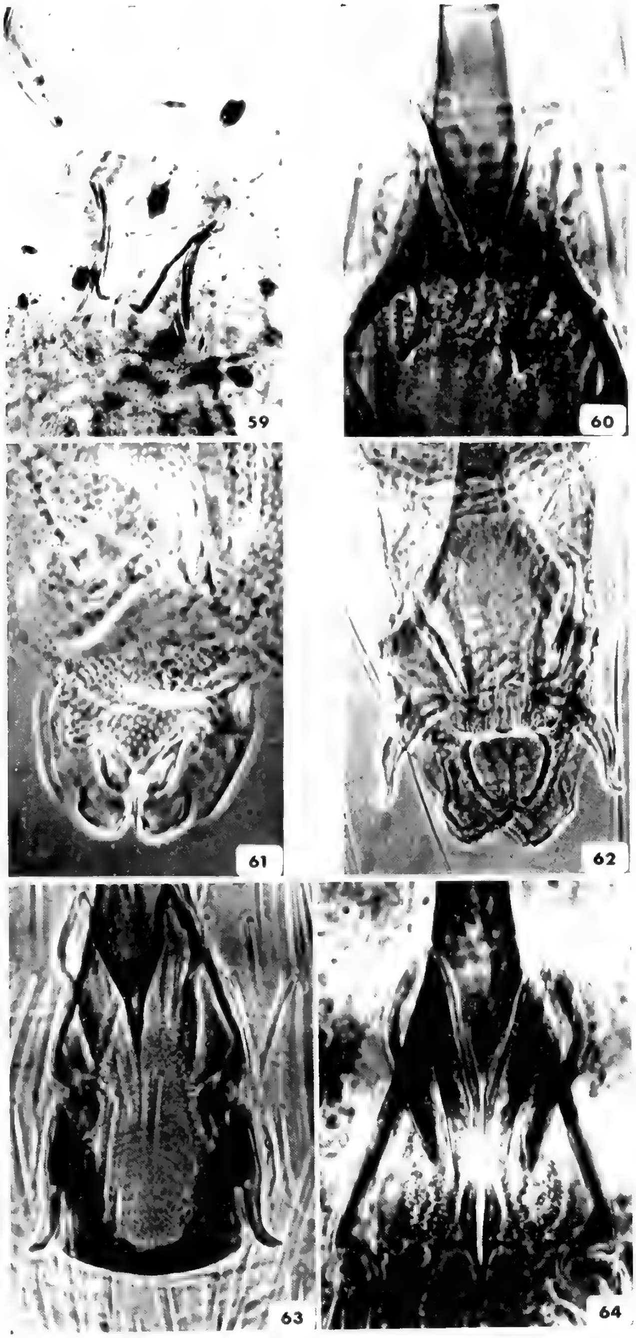
PLATE 2

Myrsidea species, ♂ genital sclerite

FIG. 59. *M. sehri*, allotype.
FIG. 60. *M. erythrocephali*.
FIG. 61. *M. sikkimensis*.
FIG. 62. *M. bhutanensis*.
FIG. 63. *M. assamensis* from *G. leucolophus belangeri*.
FIG. 64. *M. orientalis* from type-host.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Wye College

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A REVISON OF THE *LECANODIASPIS* TARGIONI-TOZZETTI (HOMOPTERA: COCCOIDEA) OF THE ETHIOPIAN REGION

By C. J. HODGSON

CONTENTS

SYNOPSIS

The females of the ten species of *Lecanodiaspis* Targioni-Tozzetti previously known from Africa south of the Sahara are redescribed, and a further three species are described as new. *Lecanodiaspis mimosae* var. *brachystegiae* Hall is raised to specific rank. A key to the species and comments on their inter-relationships are given. Lectotypes have been designated for six of the previously described species.

INTRODUCTION

The genus *Lecanodiaspis* was described by Targioni-Tozzetti in 1869 for the type-species *sardoa*. Signoret, in 1870, used both of the two spellings *Lecanodiaspis* and *Lecaniodiaspis*. Although *Lecaniodiaspis* has been used frequently since, it is now generally accepted that the correct spelling is *Lecanodiaspis* (Morrison & Morrison, 1966; Afifi & Kosztarab, 1969; Williams & Kosztarab, 1970).

This study covers the adult females from Africa south of the Sahara; the Malagasy Subregion is excluded. The remaining species from the other zoogeographic regions of the world are currently being studied in the Department of Entomology, Virginia Polytechnic Institute and State University, under the direction of Professor Kosztarab (Howell & Kosztarab, 1972).

The oldest known species from this region is *Prosopophora prosopidis* var. *mimosae* described by Maskell in 1897 from South Africa off *Acacia*. This species was placed in the genus *Lecaniodiaspis* by Cockerell in 1899, and was later very well redescribed by Morrison & Morrison (1927). Newstead described *L. africana* from North Africa in 1911, and *L. tarsalis* from South Africa in 1917. These were followed by Brain in 1920 with three further species from South Africa, *L. brabei*, *L. magna* and

L. natalensis, whilst in 1935, Hall described a new species and a new variety from Rhodesia (*L. parinarii* and *L. mimosae* var. *brachystegiae*). The first and only species so far recorded from Central Africa is *L. erratica* De Lotto described off coffee from Kenya. The most recently described species is *L. elytropappi* Munting & Giliomee, 1967, again from South Africa. Thus, prior to this revision, nine full species and a variety were known from Ethiopian Africa.

Until 1959, the genus *Lecanodiaspis* was placed in the family Asterolecaniidae Cockerell, on the grounds that it shared with *Asterolecanium* Targioni-Tozzetti 8-shaped pores. However, Borchsenius (1959) placed it in a new family Lecaniodiaspididae, along with six other genera (*Psoraleococcus* Borchsenius, *Cosmococcus* Borchsenius, *Anomalococcus* Green, *Amorphococcus* Green, *Mallococcus* Maskell and *Prosopophora* Douglas). He based these findings on adult female characters, separating it from the Asterolecaniidae on the presence of an anal cleft, whilst the 8-shaped pores excluded it from the family Coccidae.

Since the introduction of this group as having family status, additional features have been found which help to support it. Giliomee (1967*a*), whilst discussing the affinities of the male *Lecanodiaspis elytropappi* Munting & Giliomee, considered that it shared several characters with the males of the family Coccidae, but also some with the Pseudococcidae. Later Giliomee (1968), when discussing the relationships of the male of *Asterolecanium proteae* Giliomee & Munting, considered that the Lecanodiaspididae shared six characters with the family Coccidae and only two with the Asterolecaniidae. He pointed out however, that these findings were tentative, being based on only one male of each genus. In his earlier paper (1967*a* : 194), he drew attention to five characters which he felt might separate the males of Lecanodiaspididae from other groups. Work on the males of other coccid species (more particularly by Theron, 1958, 1962 and 1968; Borchsenius, 1960; Beardsley, 1962; Ghauri, 1962; Giliomee, 1961 and 1967*b*; Afifi, 1967) suggests that the main feature characterising the males of *Lecanodiaspis* is the fusion of the trochanter and femur, and this has been found to be a constant feature in the more recent study of four further species of *Lecanodiaspis* by Afifi and Kosztarab (1970).

Williams & Kosztarab (1970) outlined the characters of the 1st instar nymphs which might be characteristic of this group. These were the 8-shaped pores and anal lobe setae (also found in the Asterolecaniidae), and the anal plates and spiracular spines which, though less developed, are similar to those in the Coccidae.

Further evidence, of a different nature, of a closer relationship between the Lecanodiaspididae and the Coccidae was given by Buchner (1953), who found that the symbionts in *Lecanodiaspis* were quite different from those in the Asterolecaniidae, more closely resembling those in the Coccidae.

There are therefore a number of features of *Lecanodiaspis* which appear to be found either in the Asterolecaniidae or in the Coccidae. Much of this new data suggests that *Lecanodiaspis* and related genera may in fact be nearer the Coccidae than the Asterolecaniidae, and so perhaps they should be given the same status as the other two groups. It is possible that they should all have subfamily status, as many of the differences which were previously thought to separate these families appear to be falling away (Giliomee, 1967*b* : 105). Should it be found, however, that

they are more closely related to the Asterolecaniidae than the above points suggest, then the family-group name Lecanodiaspididae should still be used on the grounds of priority (Williams, 1969).

The following abbreviations of museums and other depositories of insect material are used in this paper.

BMNH	British Museum (Natural History)
MAS	Ministry of Agriculture, Salisbury, Rhodesia
MNHN	Muséum National d'Histoire Naturelle, Paris
NCI	National Collection of Insects, Plant Protection Research Institute, Pretoria
USNM	United States National Museum, Washington

LECANODIASPIS Targioni-Tozzetti, 1869

Lecanodiaspis Targioni-Tozzetti, 1869 : 261. Type-species: *Lecanodiaspis sardoa* Targioni-Tozzetti, by monotypy.

Lecaniodiaspis; Signoret, 1870 : 270. [Erroneous subsequent spelling.]

On the basis of the adult females, which appear to be found on the stems and twigs of the host-plants, the genus *Lecanodiaspis* can be distinguished by the following characters.

Adult female covered in a dense protective test; dermis membranous; dorsal surface covered in 8-shaped pores, tubular ducts and simple pores, with rather less frequent setae, which may be of various sizes; cribriform plates present in the abdomen, sometimes extending anteriorly onto the thorax, generally as two slightly diverging lines; anal plates as two triangular plates on the antero-ventral and lateral areas of the anal cleft, each generally with spines and ridges, and with a third plate forming the dorsal anterior margin of the cleft; marginal setae present, often tending to become spinose; stigmatic spines present or absent, when present with two spines in the anterior group, and single spines posteriorly either in one or two groups associated with ventral quinquelocular pore bands; stigmatic clefts absent; eye-spot absent. Ventral surface with a marginal ring of 8-shaped pores similar to the dorsal pores; submarginally, a further ring of smaller 8-shaped pores; within this is a sparse band of minute square-shaped pores, which reach a sub-median line formed by the antennae, coxae and anal plates; throughout the ventral surface are minute simple pores and tubular ducts; multilocular disc pores present around the genital opening, and more anteriorly; quinquelocular pores as pore bands between the spiracles and the margin, sometimes reduced to small groups near the spiracles, with the posterior bands sometimes split into two; spiracles normal; labium one-segmented, with short terminal setae; legs present, reduced or absent, when present with fine tarsal and claw digitules, and no tibio-tarsal articulatory sclerosis; antennae usually well developed, though these may also be much reduced, but the terminal three segments always with stout sensory setae; anal ring with a variable number of anal setae, and with a variable ring of small sclerotized pores; anal cleft well developed, and anal posterior lobes with single long setae and associated short setae.

Lecanodiaspis has a world-wide distribution; although typically a tropical genus, its range extends northwards into southern Europe and the southern part of the U.S.A.

KEY TO THE ADULT FEMALE *LECANODIASPIS* OF THE ETHIOPIAN REGION

1 Legs well developed, of at least three segments 2
– Legs reduced to minute stumps or entirely absent 9
2 Posterior quinquelocular pore bands divided into two 3
– Posterior quinquelocular pore bands single, or entirely absent 6
3 Dorsal setae of two sizes: one minute, the other over 45 μ long **dorsospinosa** sp. n. (p. 424)
– Dorsal setae never more than 10 μ long 4
4 Dorsal anal plate broad, with two distinct projections posteriorly; cribriform plates restricted to the abdomen . . . . **tarsalis** Newstead (p. 442)
– Dorsal anal plate narrow, with no posterior projections; cribriform plates found in the thorax as well as the abdomen 5
5 Adult female less than 2 mm long; no small group of multilocular disc pores in the genital segment on either side of the genital opening; antennae less than 200 μ long, and the tibia plus tarsus less than 70 μ long . . . . **erica** sp. n. (p. 428)
– Adult female usually longer than 2 mm; with a small group of multilocular disc pores in the genital segment on either side of the genital opening; antennae more than 200 μ long and tibia plus tarsus more than 70 μ long . **brabei** Brain (p. 419)
6 Posterior quinquelocular pore bands reduced to a small group near the spiracle **elytropappi** Munting & Giliomee (p. 426)
– Posterior quinquelocular pore band complete 7
7 Cribriform plates in two rows . . . . **africana** Newstead (p. 416)
– Cribriform plates in four rows 8
8 Femur, tibia and tarsus fused into a single segment; spines on the lateral anal plates found medially . . . . **magna** Brain (p. 433)
– Femur not fused with the tibia and tarsus; spines on the anal plates found subterminally . . . . **zygophylli** sp. n. (p. 445)
9 Posterior quinquelocular pore bands divided into two 10
– Posterior quinquelocular pore bands single or reduced 11
10 Stigmatic spines restricted to the anterior group only; stigmatic spines of approximately equal length . . . . **mimosae** (Maskell) (p. 435)
– Stigmatic spines found associated with each stigmatic band; anterior stigmatic spines of very unequal lengths . . . . **parinarii** Hall (p. 440)
11 Cribriform plates absent, or found in two distinct rows diverging slightly from the anal cleft over the abdominal segments 12
– Cribriform plates in a single group medially in the abdomen, though this may be in two adjacent rows . . . . **erratica** De Lotto (p. 431)
12 Antennae reduced to five annular ring-like segments; with four pairs of setae in the anal ring . . . . **natalensis** Brain (p. 438)
– Antennae of eight or nine segments; with five pairs of setae in the anal ring **brachystegiae** Hall (p. 422)

DESCRIPTIONS OF THE SPECIES

Lecanodiaspis africana Newstead, 1911
(Text-fig. 1)

Lecaniodiaspis africana Newstead, 1911 : 100. LECTOTYPE ♀, EGYPT, on *Acacia arabica* (BMNH), here designated [examined].
Lecaniodiaspis africana Newstead; Hall, 1922 : 7.
Lecaniodiaspis africana Newstead; Hall, 1923 : 33.
Lecaniodiaspis africana Newstead; Hall, 1925 : 18.
Lecaniodiaspis africana Newstead; Hall, 1926 : 29.

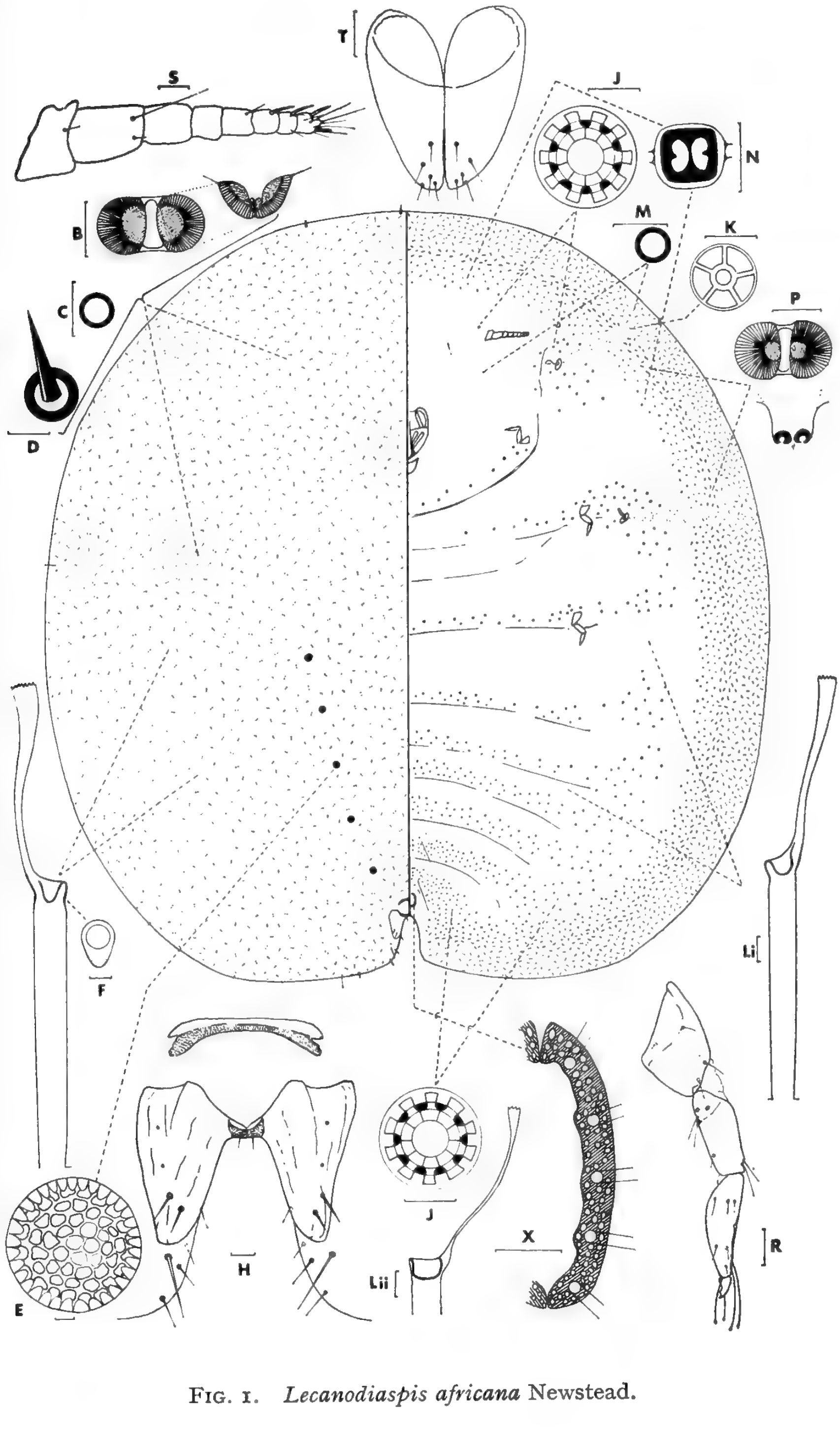

FIG. 1. *Lecanodiaspis africana* Newstead.

C

Lecaniodiaspis africana Newstead; Hall, 1927*a* : 160.
Lecaniodiaspis africana Newstead; Hall, 1927*b* : 266.
Lecaniodiaspis africana Newstead; Balachowsky, 1934 : 148.
Lecaniodiaspis africana Newstead; Bodenheimer, 1935 : 260 & 270.
Lecanodiaspis africana Newstead; Afifi & Kosztarab, 1969 : 12.
Lecanodiaspis africana Newstead; Williams & Kosztarab, 1970 : 23.

'Female ovisac—very closely felted and almost waxlike in appearance. Cream-buff or straw-coloured, becoming greyer after long exposure. Form short ovate and very highly convex; posterior half with a faint trace of a short median ridge, but this is, in old examples, more or less broken up into a series of transverse ridges, varying in intensity according to the age of the individual, but in all cases they are interrupted centrally, and in old examples they are often represented merely by minute tubercular projections. Average length, 5 mm; width, 3·5 mm.' (Newstead, loc. cit.)

Mounted material 3·0–4·0 mm long, and almost circular. Dorsal surface membranous, and covered in (i) numerous 8-shaped pores (B) (with those marginally a little larger than elsewhere), (ii) tubular ducts (F), (iii) minute simple pores (C), and (iv) (much less numerously) minute dorsal setae (D). In the abdomen, diverging from the anal opercular, are two rows of cribriform plates (E), normally five per row, each with very numerous pores; they appear to be concave. Anal plates (H) moderately sclerotized, 132–160 μ long, not heavily ridged, and with two stout setae sub-apically; with 1–3 small pores medially; dorsal plate rather narrow, though possibly bifid laterally. Marginal setae rather few and finely setose laterally, though with a few spinose setae present at the anterior and posterior ends. Stigmatic spines entirely absent.

Ventral surface membranous, with multilocular (10) disc pores (J) abundant around the genital opening and in all the preceding abdominal, thoracic and cephalic segments, becoming scarcer anteriorly, but with concentrations near the bases of the legs and near the spiracles; the rows of pores broadening laterally. Quinquelocular pores (K) in broad bands from the spiracles to the margin, where the lines end abruptly; the posterior band is undivided. Spiracles normal though rather small, with the width of the anterior opening about 65 μ. Throughout the ventral surface are minute simple pores (M), though these are more frequent marginally, and ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere except that the outer ductule is a little broader, and the inner ductule a little thinner; elsewhere the ducts (Li) are similar to the dorsal ducts but a little smaller. Marginally, the dorsal 8-shaped pores (B) become rather more frequent than dorsally, forming a rather narrow marginal band; within this is a further band 3–4 pores wide, of ventral 8-shaped pores (P); whilst inside this is a band of square-shaped pores (N); these bands extending to between half and two-thirds of the distance from the margin to the spiracles. Setae rather sparse on the ventral surface, with one pair between the antennae, single pairs of rather long setae in the last pregenital segments, and supplemented on the last two segments by groups of small setae. Legs (R) rather small, with a tendency for the fusion of the trochanter and femur, and of the tibia and tarsus; with a distinct denticle on the claw, and with minutely knobbed digitules; dimensions (iii): trochanter plus femur 70–82 μ, tibia plus tarsus 64–72 μ. Antennae (S) also rather small, of eight segments, 225–250 μ long, with some fairly long fine setae apically. Labium (T) one-segmented, 85 μ long, with five pairs of small terminal setae. Anal ring (X) heavily sclerotized with three parallel rows of small pores and ten anal setae evenly spaced around the anal ring. Anal cleft (H) with one pair of small setae at the anterior end, and with a small pair laterally; the anterior end is heavily sclerotized, joining the lateral anal plates. Posterior lobes (H) with three small setae, and one pair of relatively long setae (26–30 μ).

Redescribed from the following material labelled *Lecaniodiaspis africana* Newst., ? Antonina Africana:

Lectotype ♀, EGYPT: Ezbet et Nakhl, on 'Sunt' (*Acacia arabica*) (Leguminosae), Nov. 1909 (*Willcocks*), (R.N., May 1911), BMNH 1945, 121.

Paralectotypes. Data as for lectotype, 4 ♀ on 4 slides, BMNH 1945, 121.

Also seen, though not used in the above redescriptions:

NIGERIA: Kano, on *Acacia* sp., 8.ii.1962 (*W. J. Hall* (28)), BMNH. SUDAN: Medani, on *Ficus benghalensis* (Moraceae), 8.iii.1938 (*H. W. Bedford*), IIE 129, BMNH 1958, 578 (labelled *Lecaniodiaspis* nr *magna* Brain). MALI ('Soudan'): locality not stated, ex *Acacia* sp., 30.v.1922 (*J. Mimeur*), MNHN. MAURITANIA: Agadès, Sahara soudanais, ex *Acacia* sp., July 1947 (*L. Chopard*), MNHN.

Also from Africa, though not quite within the Ethiopian Region:

ALGERIA: Hoggar, Oued Arak (Mouydir), ex *Acacia seyale*, March 1928 (*P. de Peyerimhoff*), MNHN; Hoggar, Pied est Tifedest, ex *Acacia tortalis*, 12.iv.1928 (*R. Maine*), MNHN. LIBYA: Fezzan, Bir Abaceur, 40 km north Rhat, ex *Zizyphus* sp. (Rhamnaceae), 23.iii.49 (*A. Balachowsky*), MNHN; Fezzan, 30 km north Rhat, ex *Acacia* sp., 28.iii.1949 (*A. Balachowsky*), MNHN.

The rest of the material differed from the type-series in the following characters: there was a reduction in the number of multilocular disc pores anteriorly, becoming rather scarcer near the anterior spiracle and near the antennae; the marginal spines at the anterior and posterior ends tended to become more spinose in some cases; occasionally the number of cribriform plates was reduced, in one case to four pairs; some of the dimensions differed and the total ranges of the antennae were 225–296 μ, with a tendency for segment two to become more annular in the shorter antennae; also the trochanter plus femur was 52–82 μ, and the tibia and tarsus 56–80 μ; the anal plates 130–171 μ.

This species is probably most closely related to *L. magna* and *L. zygophylli*, but is immediately separable from them in having only two rows of cribriform plates. Apart from this, *L. zygophylli* and *L. africana* are almost identical in the adult female, but the 1st instar nymphs also differ, the former species having three quinquelocular pores in the anterior pore bands, whilst the latter species has only two (Williams & Kosztarab, 1970 : 23). The main characters of these three species appear to be: (i) the complete lack of stigmatic spines; (ii) the undivided posterior band of quinquelocular pores; (iii) the multilocular disc pores tending to be found commonly in the thorax as well as the abdomen; (iv) the eight-segmented antennae; (v) marginal setae that tend to become more spinose anteriorly and posteriorly; (vi) anal ring with five pairs of anal setae, and three rows of small pores; (vii) legs normally developed, but small, with a tendency for fusion of the segments; (viii) anal plates not usually heavily ridged; and (ix) the tubular ducts posterior to the genital opening lacking the swollen base to the inner ductule.

Lecanodiaspis brabei Brain, 1920
(Text-fig. 2)

Lecaniodiaspis brabei Brain, 1920 : 117. LECTOTYPE ♀, SOUTH AFRICA, on *Brabeium stellatifolium* (USNM), here designated [examined].
Lecanodiaspis brabei Brain; Afifi & Kosztarab, 1969 : 18.
Lecanodiaspis brabei Brain; Williams & Kosztarab, 1920 : 33.

'Test of the adult ♀ about 3·2 mm long, 2 mm wide, and 1·5 mm high, oval convex, ochre yellow, with a thin covering of greyish secretion which is easily flaked off. The dorsum is not

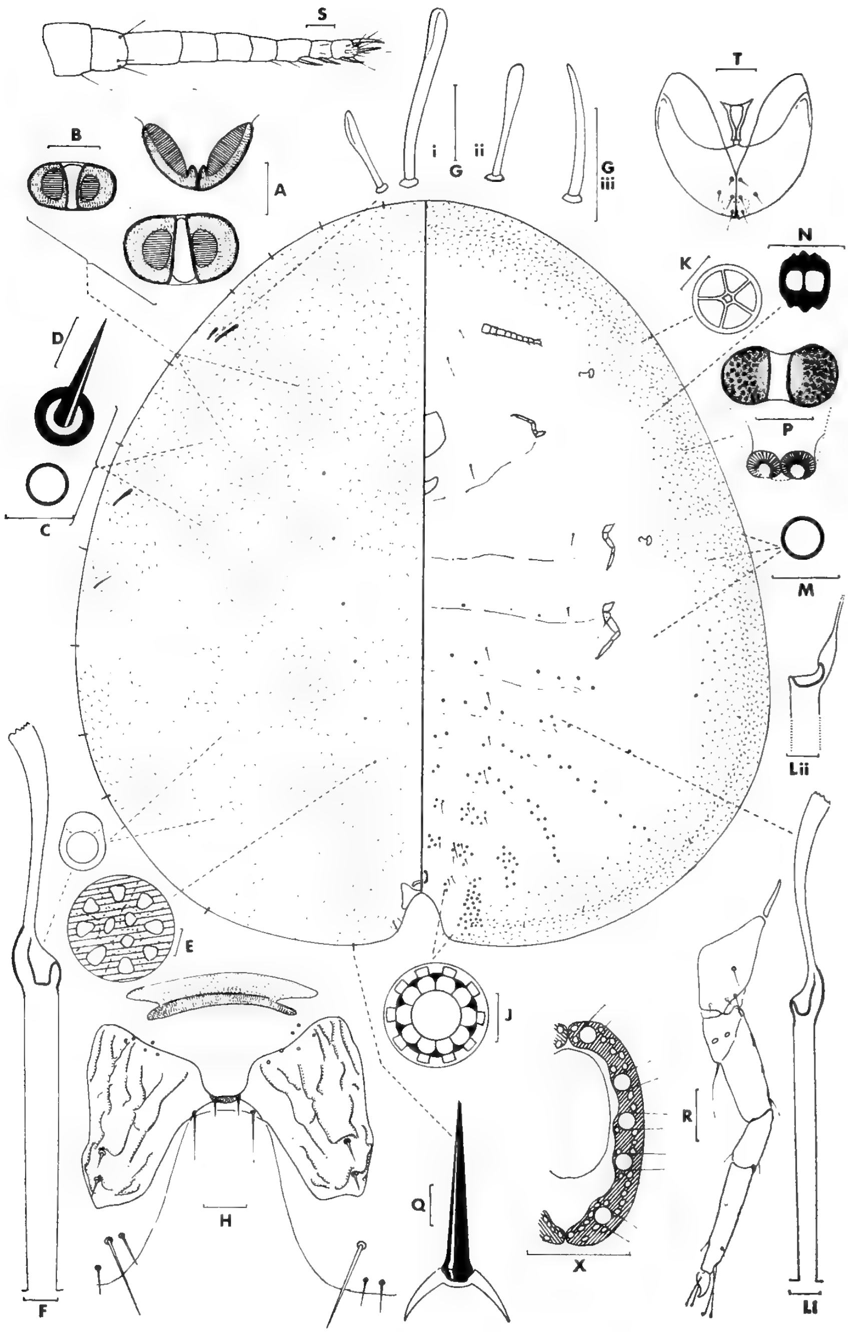

FIG. 2. *Lecanodiaspis brabei* Brain.

quite smooth, but has faint rounded rib-marks and occasionally a faint median ridge. With the roughened secretion removed the colour and general appearance of this species is very like the figure Green gives of his *L. azadirachtae*, '♂ puparium of the usual type, pale buff coloured, not yellow as in the female test.' (Brain, loc. cit.)

Mounted material oval, tending to be broader at the posterior end, and 1·4–3·0 mm long. Dorsal surface membranous, covered in 8-shaped pores of two sizes, the larger (A) being much more common than the smaller (B), which is apparently found intersegmentally. Also throughout the dorsal surface are minute simple pores (C), tubular ducts (F), and rather infrequently minute dorsal setae (D). Two slightly diverging lines of 5–6 cribriform plates are present over the anterior abdominal segments and the thorax, each plate with 7–20 pores. Anal plates (H) distinctly ridged longitudinally, with two sub-apical setae, and with a group of 3–7 small pores near the anterior margin; length 90–110 μ; dorsal plate rather narrow, and generally broadest medially. Marginal spines about 12 per side, with rather large basal discs; length 13–19 μ. Stigmatic spines present (G), with two spines in the anterior group (lengths 40–75 μ and 15–26 μ) and single spines associated with each of the posterior pore bands (25–43 μ and 28–40 μ long respectively); all have rather spatulate ends.

Ventral surface membranous, with multilocular (10) disc pores (J) in a small group on either side of the genital opening, and frequent in all the preceding abdominal segments; there are also a few medially in the metathoracic segment and occasionally in the mesothorax. Quinquelocular disc pores (K) in broad bands between the spiracles and stigmatic spines, the pores most frequent marginally, where the bands narrow towards the spines. Throughout the ventral surface are minute simple pores (M), which are rather sparse medially, and ventral tubular ducts of two sorts: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere except that the outer ductule is a little broader, and the inner ductule a little thinner with a broadened base; elsewhere the ducts (Li) are similar to those dorsally, but a little smaller. Forming a narrow marginal band are the larger dorsal 8-shaped pores (A); just within this is a band of ventral 8-shaped pores (P), 2-3 pores wide, whilst within this is a scattered band of square-shaped pores (N), which occur medially for about 2/3rds of the length of the stigmatic pore bands. Spiracles normal, width of anterior opening 29–34 μ. Long setae are present as two pairs between the antennae, and there is a pair medially in each of the abdominal segments and associated with the bases of all the legs; smaller setae are found in a submarginal ring, and there are several pairs in each of the last two pregenital segments. Legs (R) relatively small, with the tibia about half the length of the tarsus, with a very small denticle on the claw (often very difficult to see), and fine digitules; dimensions (iii): trochanter plus femur 60–74 μ, tibia plus tarsus 78–90 μ. Antennae (S) of nine segments; all fine terminal setae rather short; length 218–260 μ. Labium (T) one-segmented, with four pairs of small terminal setae; length 72–84 μ. Anal ring (X) heavily sclerotized, with one to two rows of small pores, and ten anal setae, fairly evenly spaced around the ring. With two pairs of setae along the anterior margin of the anal cleft (H), about evenly spaced; with a small area of dense sclerotization joining the two lateral anal plates. Posterior lobes (H) with 3–5 pairs of short setae, and a pair of fairly long setae (28–40 μ).

Redescribed from the following material labelled *Lecaniodiaspis brabei* Brain:
Lectotype ♀, SOUTH AFRICA: Newlands, Cape Province, ex *Brabeium stellatifolium* (Proteaceae), Dec. 1915 (*C.K.B.*) 298, USNM 39 2836.

Also used for above redescription:

SOUTH AFRICA: Cape, Villiersdorp, ex Wild Almond (*Brabeium stellatifolium*), Sept. 1932 (*F. A. Fouché* per H. K. Monro), 8 ♀ on 3 slides, BMNH.

Also seen:

SOUTH AFRICA: Cape Province, on Wild Almond, 18.v.1906 (*T.F.D.*), 5 ♀ on 1 slide, C.K.B., USNM; Cape No. 1274 (note: this slide is marked 'Paratype', although no holotype was designated by Brain; also, according to Brain (1920 : 118), this

Cape No. was given to another slide, or lot of material, although this slide is clearly marked 1274); Stellenbosch, ex *Brabeium stellatifolium*, 17.v.67 (*V.B. Whitehead*), NCI; Cape Province, Thorngrove Rail, ex *Tecoma* sp. (Bignoniaceae), May 1946 (*W.G. Leppan*), BMNH; also a slide labelled *Lecaniodiaspis capensis* Brain (a manuscript name), ex coll. Dept. Agric. Pretoria, 10.xi.28, det. Brain, BMNH.

L. brabei is one of a group of rather closely related species from Southern Africa, which includes *L. brabei*, *L. dorsospinosa*, *L. erica*, *L. elytropappi* and *L. tarsalis*. The main characters of these species appear to be: (i) two sizes of dorsal 8-shaped pores, the smaller generally found intersegmentally; (ii) cribriform plates in two rows, with relatively few pores; (iii) posterior stigmatic pore bands divided, each with a stigmatic spine; (iv) marginal setae spinose, with large basal discs; (v) fairly well ridged anal plates; (vi) nine-segmented antennae; (vii) multilocular disc pores very scarce anterior to the abdomen; (viii) legs relatively short, with the tibia much shorter than the tarsus; (ix) the anal ring with five pairs of anal setae, and with one complete and one incomplete row of small pores; (x) the labium with two median areas of dense sclerotization; and (xi) posterior lobes with generally rather few of the short setae.

The material from *Tecoma* sp. tended to be a little larger, and the cribriform plates had up to 25 pores per plate; otherwise it was very similar. The differences from *L. erica*, which is very close to *L. brabei*, are discussed on p. 429.

Lecanodiaspis brachystegiae Hall, 1935, **stat. n.**
(Text-fig. 3)

Lecaniodiaspis mimosae var. *brachystegiae* Hall, 1935 : 219. Holotype ♀, RHODESIA, on *Brachystegia* sp. (BMNH) [examined].

No dried material available, and the original short description by Hall does not include a description of the unmounted material.

Mounted material rather square in shape, and 2·5–3·0 mm long. Dorsal surface membranous, with 8-shaped pores found throughout the dorsal surface, those nearer the margin being a little larger than medially; also found throughout the dorsal surface are minute simple pores (C), and tubular ducts (F), which have the outer ductule internally ridged. Minute dorsal setae (D) are found very sparsely. Five pairs of cribriform plates (E) present in two slightly diverging lines medially in the abdominal segments; they are irregular in shape, very concave, and with numerous pores per plate. Anal plates (H) normally developed, with rather few longitudinal ridges; with two small pores antero-laterally, and with two stoutish spines postero-laterally (occasionally there is a third seta as well); length 104–130 μ; dorsal plate rather narrow and semicircular, Marginal setae spinose, about 17 per side with small basal discs. Stigmatic spines entirely absent.

Ventral surface membranous, with multilocular (10) disc pores (J) around the genital opening and in all the preceding abdominal segments; they are also found sparsely in the thorax and head. Quinquelocular disc pores (K) rather few, in a very narrow band just reaching the margin anteriorly, but posteriorly restricted to a small group 14–20 near the spiracle, just reaching the band of ventral 8-shaped pores laterally. The dorsal 8-shaped pores form a marginal band of moderate width; within this is a band of ventral 8-shaped pores (P) about 3–4 pores wide. Between this and an imaginary line formed by the antennae, legs and anal plates is a band of square-shaped pores (N). Ventral tubular ducts of two types: immediately posterior to the

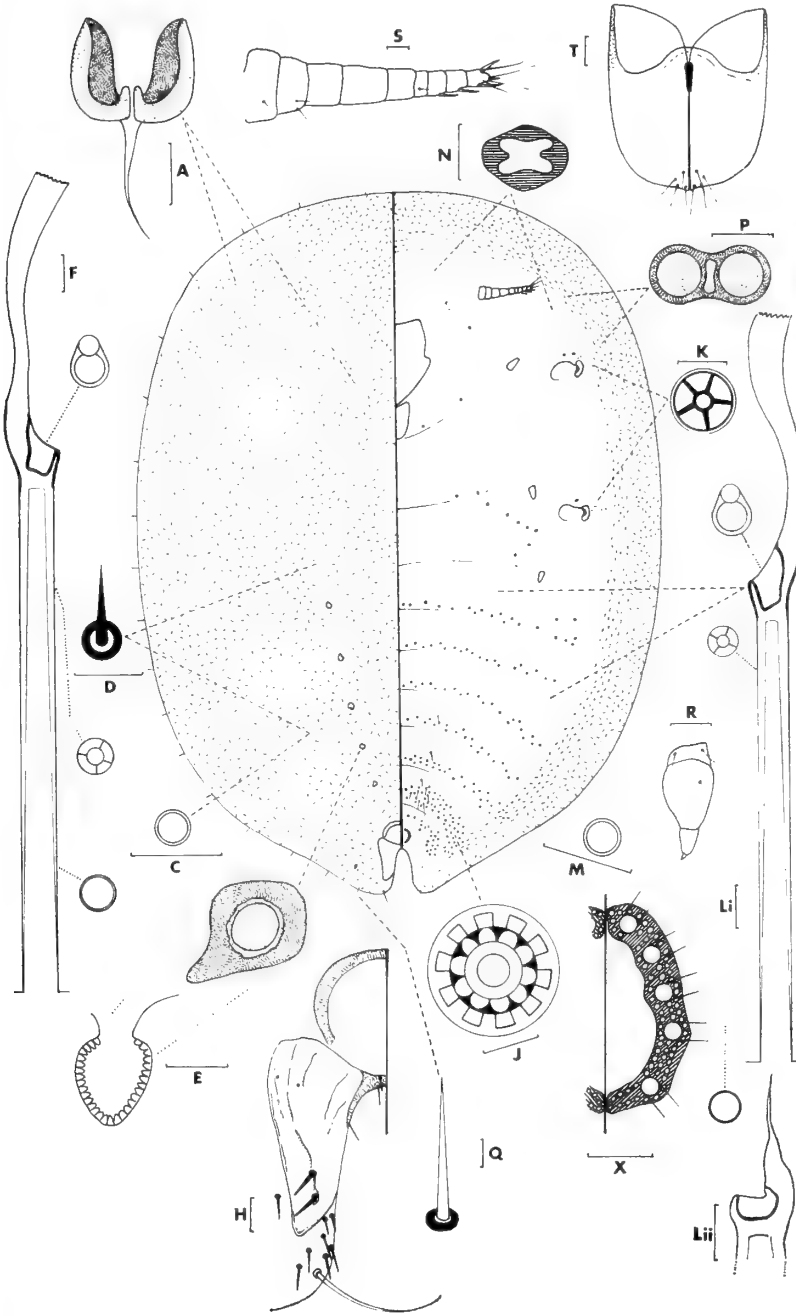

Fig. 3. *Lecanodiaspis brachystegiae* Hall.

genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is a little broader and the inner ductule a little thinner with a broadened base; elsewhere the ducts (Li) are similar to the dorsal ducts, but a little smaller. Minute simple pores (M) are found throughout, but are very sparse medially. Ventral setae rather few, with a single pair between the antennae, about six to eight pairs in the pregenital segment, and single pairs in the preceding two segments; there is also a very sparse submarginal ring of small setae. Spiracles normal; width of anterior opening 39–46 μ. Antennae (S) of nine segments, with a tendency for some segments to become annular; terminal fine setae all rather short; length 218–278 μ. Legs (R) minute, reduced to 1–3 segments, possibly occasionally entirely absent; with a small claw, but no digitules. Labium (T) of one segment, rather elongate, with four pairs of short terminal setae; length 130–144 μ. Anal ring (X) with ten anal setae, and composed of three more or less complete rows of small pores. Anal cleft (H) with an area of dense sclerotization joining the lateral anal plates on which there is a small pair of setae, with another pair laterally (there is also another small pair between the cleft and the genital opening). Terminal lobes with a single pair of long setae (73–90 μ long), and with 6–8 pairs of shorter setae.

Redescribed from the following material labelled *Lecaniodiaspis mimosae* var. *brachystegiae* Hall:

Holotype ♀, RHODESIA: Salisbury, The Kopje, on *Brachystegia* sp. (Leguminosae), 23.xi.27 (*W. J. Hall* (127)), BMNH 1936, 632.

Paratypes. 3 slides and six specimens with same data as Holotype, BMNH.

The main differences between *L. mimosae* and *L. brachystegiae* are: (i) the complete absence of stigmatic spines in *brachystegiae*; (ii) the extreme reduction of the posterior stigmatic pore bands to a small group of pores near the spiracle; (iii) the shape of the labium, which is very much more elongate in *brachystegiae*; (iv) the form of the cribriform plates, which are convex in *mimosae* and concave in *brachystegiae*, and (v) the ventral 8-shaped pore band is rather wider in *brachystegiae* than in *mimosae*. They are however closely related, and appear to fall into a group which also contains *L. erratica* and *L. natalensis*. The main characters of this group are given under *L. mimosae*.

Lecanodiaspis dorsospinosa sp. n.

(Text-fig. 4)

'The specimens were exactly the colour of the bark, and as they were young adults which had not yet secreted a covering, they were very flat.' (J. Munting, personal communication.)

Dorsal surface membranous, with two sizes of 8-shaped pores—the larger (A) in a narrow band marginally, and in a median line from which short branches run laterally about half way to the margin; elsewhere the dorsal surface is covered in the smaller type of 8-shaped pore. Also found throughout the dorsal surface are minute simple pores (C), and fairly large tubular ducts (F). There are also the usual rather sparse minute setae (Di), but in addition, there are some very long spinose setae (Dii), 28–50 μ long, with large basal discs—these are found in two rows medially, and also in no particular pattern laterally. Cribriform plates (E) more or less circular, with 10–15 pores, and present in two parallel rows of 7–8 plates in the thorax and first five abdominal segments. Anal plates (H) well sclerotized, 102–105 μ long, quite richly ridged, with two stout setae towards the posterior end, with a small group of pores near the anterior edge, and with one also present towards the centre of the plates; dorsal plate normal. Stigmatic spines present, associated with all the stigmatic pore bands, with two anteriorly (G), lengths 43–45 μ

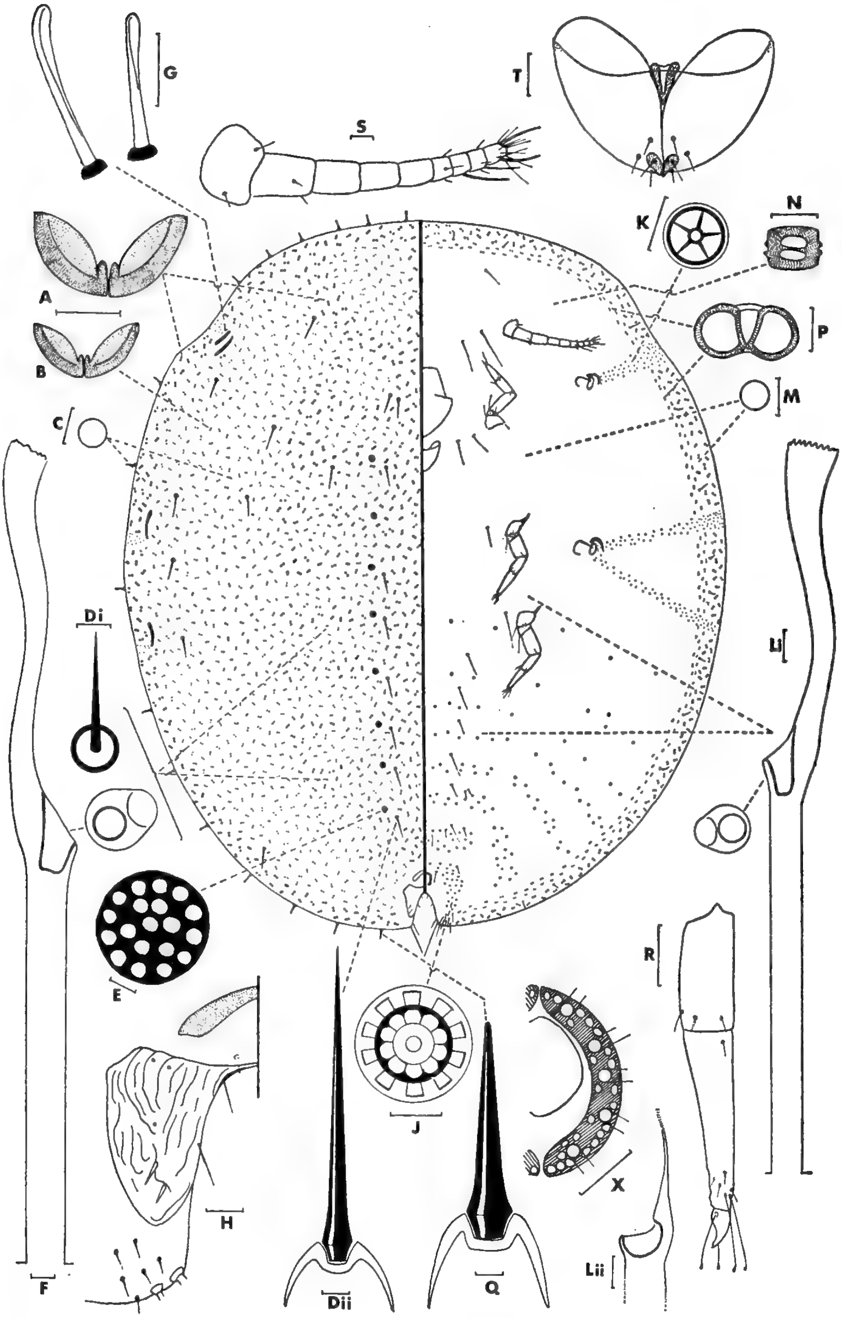

FIG. 4. *Lecanodiaspis dorsospinosa* sp. n.

and 49 μ respectively, and singly posteriorly associated with each of the divided pore bands, 49–52 μ and 49 μ respectively; they all have slightly spatulate ends. Marginal setae (Q) large, spinose, with well developed basal discs, length 23–26 μ; there are 14–16 per side.

Ventral surface membranous, with multilocular (10) disc pores (J) around the genital opening and in all the preceding abdominal segments, and in the metathorax; there is a tendency for the number of loculi to fall off anteriorly. Quinquelocular disc pores (K) in the normal stigmatic bands, the posterior band divided into two; the anterior band is broader, and the pore frequency increases towards the margin in all bands. The larger dorsal 8-shaped pores form a narrow marginal band, whilst inside this is a very narrow band of ventral 8-shaped pores (P) about two pores wide; between this band and an area roughly marked by the legs, antennae and anal plates is a band of minute square-shaped pores (N). Throughout the ventral surface are minute simple pores (M), which are most frequent marginally, and ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere except that the outer ductule is a little broader and the inner ductule a little thinner with a broadened base; elsewhere the ducts are similar to the dorsal tubular ducts, though a little smaller. Spiracles normal, though tending to become surrounded by an area of dense sclerotization; width of the anterior spiracular opening 31–33 μ. Ventral setae often unusually long, found as a single pair anterior to the antennae, two pairs between the antennae, and two pairs associated with the anterior coxae; there are also single pairs associated with the other coxae, and medially in each of the abdominal segments; much smaller setae are found medially in the last three pregenital segments; they also form a submarginal ring, and are found sparsely throughout the rest of the ventral surface. Antennae (S) nine-segmented, with the distal stout setae unusually long, but the finer setae all rather short; length 258–290 μ. Legs proportionately a little small, with no tibio-tarsal articulatory sclerosis, with a small denticle on the claw, and with fine digitules; dimensions (iii): trochanter plus femur 102–104 μ; tibia plus tarsus (R) 92–102 μ. Labium (T) one-segmented, with four pairs of small terminal setae; length 72–85 μ. Anal ring (X) well sclerotized, with one complete and one incomplete ring of small pores, and with ten long anal setae. With only a small area of dense sclerotization joining the lateral anal plates, with a pair of long setae associated with it, and another pair laterally (H). Each posterior terminal lobe (H) probably with two pairs of long setae, though these are only represented by their basal discs in the available material; associated with them are 4–6 pairs of smaller setae.

Holotype ♀., South Africa: Transvaal, 23 miles south of Barberton, on *Ziziphus mucronata* (Rhamnaceae), 24.iii.1968 (*S. Slater*), NCI.

Paratypes, South Africa: Transvaal, 23 miles south of Barberton, on *Ziziphus mucronata*, 24.iii.1968 (*S. Slater*), 3♀ on 3 slides, NCI.

This species is immediately separable from all other species of *Lecanodiaspis* known from Africa by the very long dorsal setae. It falls into the *L. brabei*–*L. tarsalis* group, whose characters are given under *L. brabei*.

Lecanodiaspis elytropappi Munting & Giliomee, 1967
(Text-fig. 5)

Lecaniodiaspis elytropappi Munting & Giliomee, 1967 : 102. Holotype ♀, South Africa, Ceres, ex *Elytropappus rhinocerotis*, 23.1.1965, (*J. H. Giliomee*) (NCI).
Lecaniodiaspis elytropappi Munting & Giliomee; Giliomee, 1967*a* : 185.

'Test of fully mature female oval, dirty-white in colour, about 3 mm long and 1·3 mm wide; male puparia elongate, about 1 mm in length and similar in colour to that of the female.' Munting & Giliomee, loc. cit.)

Mounted material 1·1 mm long, and elongate oval. Dorsal surface membranous, and covered in 8-shaped pores of more or less two sizes, arranged so that the larger pores (A) are found along

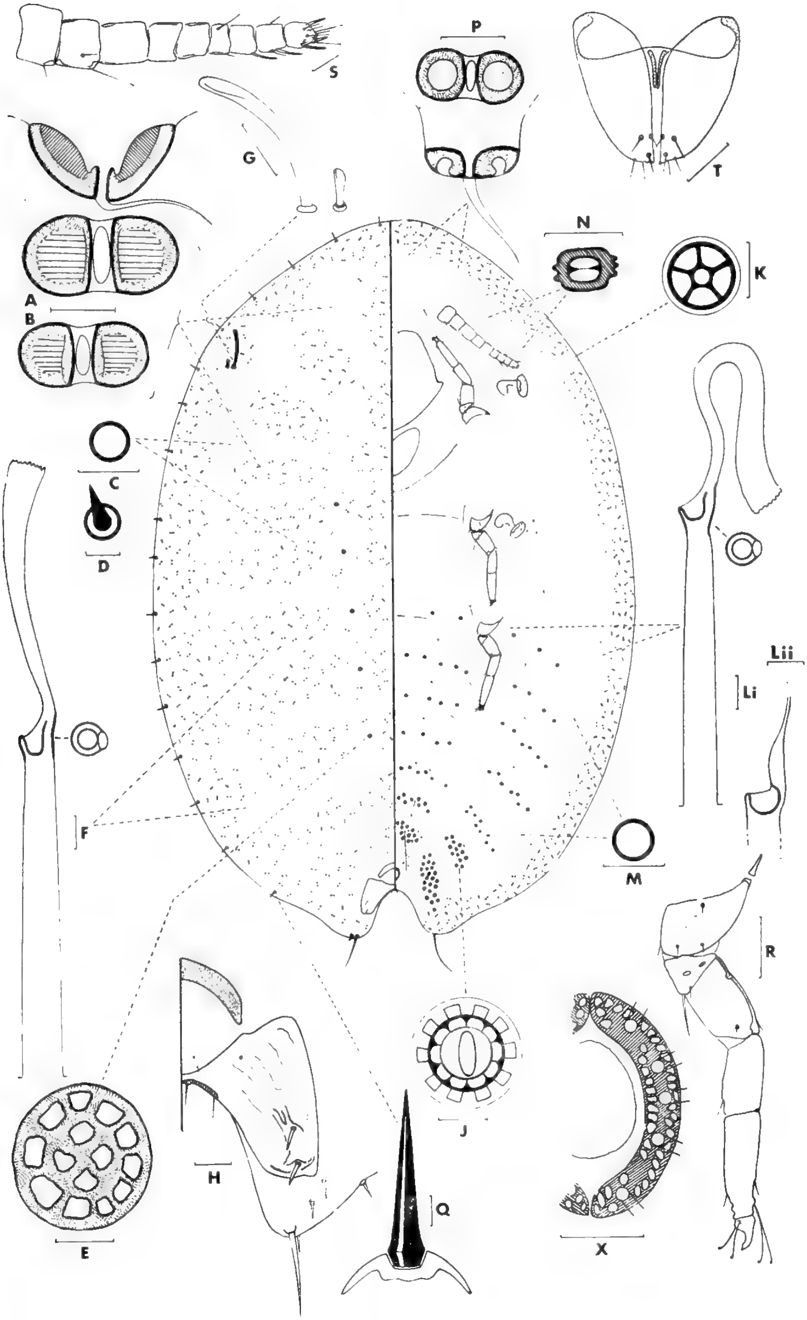

FIG. 5. *Lecanodiaspis elytropappi* Munting and Giliomee.

the ridges of the segments, and the smaller pores (B) lying between. Also found throughout the dorsal surface are minute simple pores (C), tubular ducts (F), and rather infrequently, minute dorsal setae (D). In two median almost parallel lines are 5–8 cribriform plates (E), lying over the thoracic and anterior abdominal segments, each with 9–15 pores. Anal plates (H) with rather few well sclerotized ridges, with a small pore anteriorly and two stout setae posteriorly; length of plates 110–113 μ; dorsal anal plate rather narrow. Marginal setae (Q) sharply spinose, well developed with large basal discs, with 16–18 per side; length 10–12 μ. Stigmatic spines (G) restricted to the anterior cleft, with one larger spine (61–63 μ) and a rather shorter spine (8–12 μ), both with spatulate ends.

Ventral surface membranous, with multilocular (10) disc pores (J) in the pregenital segment, and in all the preceding abdominal segments, and in the metathorax. Quinquelocular pores (K) in a well developed band between the anterior spiracle and the stigmatic spines, the pores being most frequent marginally; the posterior band is reduced to a small group of 4–9 pores in the immediate vicinity of the spiracle. Throughout the ventral surface are minute simple pores (M), which become rather scarce medially, and ventral tubular ducts of two sorts: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere except that the outer ductule is a little broader and the inner ductule a little thinner with a broadened base; elsewhere the ducts are similar to the dorsal ducts, but a little smaller. The larger dorsal 8-shaped pores (A) form a narrow marginal band; within this is a very narrow band about two pores wide of ventral 8-shaped pores (P). Between this and the spiracles is a scattered band of minute square-shaped pores (N). Spiracles normal, with the anterior spiracular opening 28–31 μ wide. Large ventral setae present as 3–4 between the antennae, a pair near the coxae of the legs and medially in all the abdominal segments —that of the pregenital segment being particularly long; shorter setae are found in a submarginal ring, and in a second ring about level with the spiracles; they are also present in small groups in the last four pregenital segments. Labium (T) one segmented, 73 μ long, with five pairs of small terminal setae. Legs (R) relatively small, with no tibio-tarsal articulatory sclerosis, with a distinct denticle on the claw, and with fine digitules; dimensions (iii): trochanter plus femur 49–53 μ, tibia plus tarsus 67–70 μ. Antennae (S) nine-segmented, (occasionally 8, with a pseudo-articulation in the sixth segment); length 208–212 μ; with all the fine setae on the terminal segment short. Anal ring (X) well sclerotized, with two rows of small pores and with ten anal setae. Anterior margin of the anal cleft between the lateral anal plates not very heavily sclerotized, with two pairs of setae. Posterior lobes with three pairs of short setae, and one fairly long pair (46–49 μ).

Redescribed from 2 slides with 2 paratype specimens labelled *Lecaniodiaspis elytropappi* Munt. & Gil., from:

SOUTH AFRICA: Cape, Ceres, ex *Elytropappus rhinocerotis* (Compositae), 23.i.65 (*J. H. Giliomee*), BMNH.

This species belongs to the *L. brabei–L. tarsalis* group, the main characters of which are given under *L. brabei*. It differs from the others in the restriction of the stigmatic spines to the anterior group, and the reduction of the posterior pore bands to around the spiracle only.

Munting and Giliomee also described the male, and Giliomee (1967*a*) subsequently discussed its relationships within the Coccoidea.

Lecanodiaspis erica sp. n.

(Text-fig. 6)

A rather small species, 1·5 mm long, 1·1 mm wide and 0·75 mm high, and a pale biscuit colour in dried material. The tests are roughly oval in shape, perhaps slightly blunt anteriorly, and drawn out posteriorly, where there is a small cleft, which is turned upwards; the tests are

convex dorsally, with a small distinct dorsal ridge, and with indications of minute ridges running laterally. The available material is off the twigs and small branches of the host plant.

Mounted material 1·1–1·8 mm long. Dorsal surface membranous, with 8-shaped pores (A & B) throughout, with the smaller pore apparently lying intersegmentally. Also throughout the dorsal surface are minute simple pores (C), and tubular ducts (F); much less frequently are some minute dorsal setae (D). Cribriform plates (E) in two parallel lines medially over the abdomen and posterior thoracic segments, with 3–6 in each row; with 25–26 pores in each plate. Anal plates (H) fairly well sclerotized, with several well formed ridges, and two pairs of subterminal stout setae; with three small pores anteriorly in each plate; length of plates 102–116 μ; dorsal plate well sclerotized, fairly narrow, and possibly bifid laterally. Marginal setae (Q) spinose, 8–15 μ long, shorter towards the anterior end, and with only moderately well developed basal discs; with 13–15 per side. Stigmatic spines (G) present, with a long, slightly spatulate, blunt spine (49–68 μ long) and a very short spine (11–16 μ long) associated with the anterior pore bands; the posterior two pairs of spines also have spatulate ends, and are 34–49 μ long.

Ventral surface membranous, with multilocular (10) disc pores (J) in the pregenital segment and across the preceding abdominal and metathoracic segments. Quinquelocular disc pores (K) in a single band from the anterior spiracle, but in a divided band from the posterior spiracle, each band narrowing towards the margin, where the pores also become more frequent. Ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is rather broader, and the inner ductule thinner with a broadened base; elsewhere the ducts (Li) are similar to the dorsal ducts, but a little smaller, and are most frequent medially. Found throughout the ventral surface, but most frequent laterally are minute simple pores (M). Forming a fairly broad marginal band for about half the length of the stigmatic pore bands are the larger dorsal 8-shaped pores (A); lying within this band is a very narrow band of ventral 8-shaped pores (P), only about 2 pores wide. Lying between this band and the position of the spiracles is a further band of pores, the minute ventral square-shaped pores (N), which appear to be absent more medially. Ventral setae as follows: large setae restricted to the last two pregenital segments medially; medium sized setae in pairs in the median areas of the more anterior abdominal segments, and with two pairs between the antennae; small setae found occasionally laterally, in small groups just medially to the legs, and in the last two pregenital segments. Spiracles normal, with the opening of the anterior spiracle 24–28 μ wide. Legs relatively small, with no articulatory sclerosis between the tibia and tarsus, with a distinct minute denticle on the claw, and with fine digitules; dimensions (iii): trochanter plus femur 33–39 μ, tibia plus tarsus 49–65 μ. Antennae of nine segments, all slightly annular in shape; length 170–186 μ. Labium one-segmented, with four pairs of terminal setae, length 68–73 μ. Anal ring well sclerotized, with two rows of small pores, and with ten anal setae. Anterior margin of the anal cleft between the anal plates sclerotized, with two pairs of setae, the outer pair widely spaced. Posterior lobes with a pair of long setae (29–42 μ), and a single pair of short stout setae.

Holotype ♀, South Africa: Cape Province, Tradouw Pass, on the smaller stems and twigs of *Erica* sp. (Ericaceae), 11.i.1969 (*J. Munting*), NCI, H.C.No. 3437.

Paratypes, South Africa: Cape Province, Tradouw Pass, on the smaller stems and twigs of *Erica* sp., 11.i.1969 (*J. Munting*), 4 ♀ on 4 slides NCI, and 1 ♀, BMNH.

South Africa: Cape Province, Mitchell's Pass, ex *Erica* sp., 22.ii.1966 (*J. Munting*), NCI; Cape Province, Tradouw Pass, ex *Erica versicolor*, 11.i.1969 (*J. Munting*), 1 ♀, NCI.

The material from Mitchell's Pass was identical to that from Tradouw Pass, except that the tibia plus tarsus was 69–72 μ. This species belongs to the *L. brabei–L. tarsalis* group whose main characters are given under *L. brabei*. *L. erica* is also closest to *L. brabei* and differs from it in the following characters: (i) mature

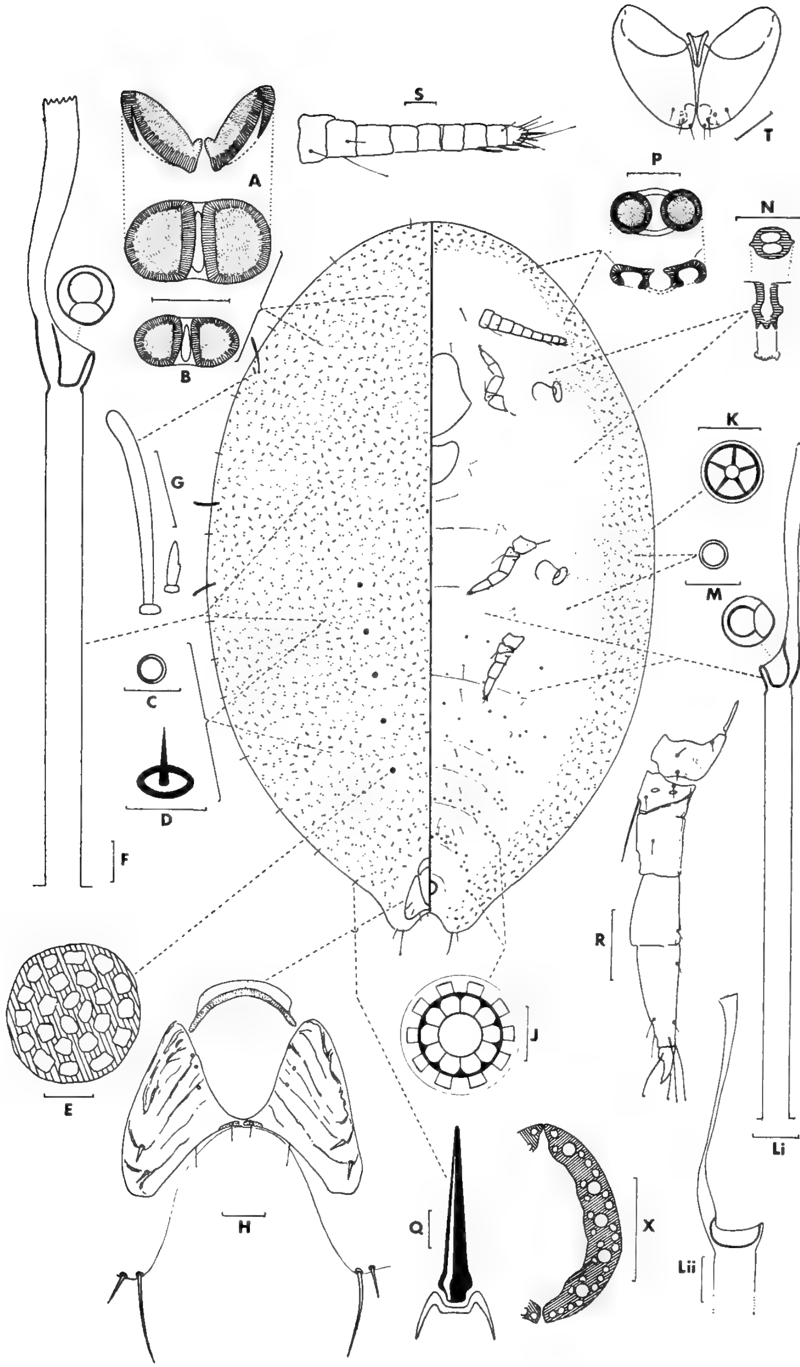

FIG. 6. *Lecanodiaspis erica* sp. n.

adult females are less than half the size; (ii) the limbs are over a third smaller, whilst the anal plates and labium are only slightly smaller; (iii) the cribriform plates tend to be larger and have more pores; (iv) the anal plates are more heavily ridged; (v) there are fewer multilocular disc pores in *L. erica*, and there is no small group of pores on either side of the genital opening, as in *L. brabei*; (vi) there are fewer setae on the posterior lobes, and (vii) the denticle on the claw is distinct, whilst in *L. brabei* it is particularly indistinct. Whilst many of these differences appear small, taken together they seem to the author quite sufficient to separate these two species.

The 1st instar nymphs of *L. brabei* have been described by Williams & Kosztarab (1970 : 33). Although the adult females of *L. erica* and *L. brabei* are rather similar, the 1st instar nymphs are very different, with four rows of 8-shaped pores dorsally in the abdomen in *brabei* and only three in *L. erica*.

Lecanodiaspis erratica De Lotto, 1955

(Text-fig. 7)

Lecaniodiaspis erratica De Lotto, 1955 : 269. Holotype ♀, KENYA, on *Coffea arabica* (BMNH) [examined].

'Test of the adult female circular, moderately convex with a small operculum at the anal end; colour light brown, at times darker on the median area. Diameter 2–2·5 mm.' (De Lotto, loc. cit.)

Mounted material almost circular, 1·2–1·8 mm long. Dorsal surface membranous, with numerous tubular ducts (F), which have the outer ductule with internal ridges; rather sparse 8-shaped pores (B); minute simple pores (C), and very infrequent minute setae (D). Marginally, the 8-shaped pores are larger (A). Cribriform plates relatively large, generally rather oval in shape, with numerous pores, and found medially about the 2nd and 3rd abdominal segments, either as two closely adjacent lines of four plates, or as a compact group of plates. Anal plates (H) not heavily sclerotized, 42–52 μ long, and with almost no ridges—a few present along the posterior edges; each plate has three latero-terminal stout spines, and also two finer setae towards the centre; small pores appear to be absent; dorsal plate almost square, with a heavily sclerotized posterior edge. Body margin hard to define, completely lacking in stigmatic spines, but with about 14 fairly long fine setae along each side.

Ventral surface membranous, with multilocular (10) disc pores (J) around the genital opening, and in all the preceding abdominal segments. Quinquelocular disc pores (K) present only as a small group near the spiracles, 7–10 near the anterior and 5–6 near the posterior spiracle; there is a slight tendancy for them to become multilocular. Forming a marginal ring are the larger 8-shaped pores (A), whilst immediately within this is a very narrow band of slightly smaller ventral 8-shaped pores (P). Inside this is a band of square-shaped pores (N); these occur to about half way to the spiracles. Minute simple pores (M) are found throughout the ventral surface, but are most common laterally. The ventral tubular ducts are of two types: immediately posterior to the genital opening is a small group of pores (Lii) similar to those elsewhere, except that the outer ductule is a little broader and the inner ductule a little thinner, but broadened at the base; elsewhere the ducts (Li) are similar to the dorsal ducts, but a little smaller. Spiracles normal, width of the anterior opening 26–28 μ. Ventral setae apparently reduced, with a single pair between the antennae, and a pair in the last two pregenital segments; a few minute setae occur scattered throughout the ventral surface, and also form a submarginal ring. The legs (R) are reduced or absent, rarely composed of more than one segment with a

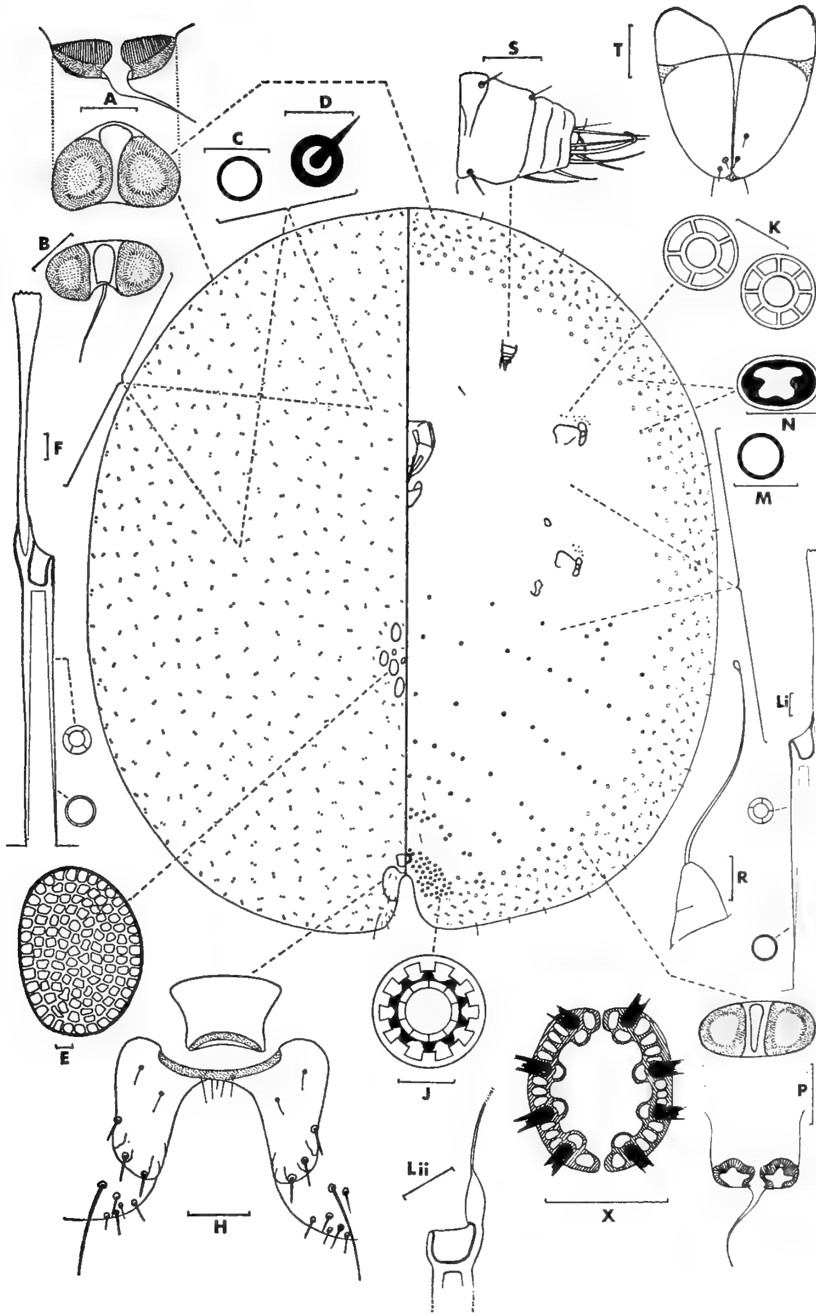

FIG. 7. *Lecanodiaspis erratica* De Lotto.

few small setae, and perhaps a terminal digitule. Antennae (S) also reduced, of 3–5 ring-like segments, the terminal three having stout sensory setae and a few fairly short fine setae; length 36–49 μ. Labium (T) one-segmented, with three pairs of small terminal setae; length 77–78 μ. Anal ring well sclerotized, with one complete and one very incomplete row of small pores, and eight anal setae, evenly spaced around the ring. Anterior margin of the anal cleft with a heavily sclerotized ridge joining the lateral anal plates, and a single pair of setae (though there is a small group of 3–4 between the anterior margin and the genital opening). Posterior lobes with a single long seta (28–34 μ), and with a small group of 5–7 short setae.

Redescribed from the following material labelled *Lecaniodiaspis erratica* De Lotto:

Holotype ♀, KENYA: Kiambi, ex *Coffea arabica* (Rubiaceae), 17.vii.1942 (*De Lotto*), BMNH 1963 : 212.

Paratypes: As above for holotype, 11 ♀ on 11 slides, BMNH 1963 : 212.

Also seen, but not used in the above redescription:

KENYA: Ruiru, ex Coffee, May 1931 (*T. L. McClelland*), BMNH; Kiambu, ex Coffee, 9.xii.1929 (*T. J. Anderson*), BMNH.

This species and *L. natalensis* appear to be fairly closely related; they share the following characters: (i) eight setae in the anal ring; (ii) tubular ducts with internal ridges; (iii) limbs very much reduced or absent; (iv) antennae reduced to a few annular segments; (v) stigmatic spines entirely absent; (vi) quinquelocular pore bands reduced to a small group immediately adjacent to the spiracles, and (vii) dorsal 8-shaped pores of two sizes, the larger restricted to the margin. They differ in the form of their anal plates, with three sub-apical setae, and two smaller ones around the middle of each lateral plate in *erratica*, whilst they are restricted to two stout sub-apical setae in *natalensis*; and in the position and presence of cribriform plates, which appear to be generally absent in *natalensis*, but when present are probably as two diverging lines rather than the medial group in *erratica*. The adult females also differ in shape, *erratica* being practically circular, whilst *natalensis* is distinctly elongate ovate. See under *L. mimosae* for further comments.

Lecanodiaspis magna Brain, 1920
(Text-fig. 8)

Lecaniodiaspis magna Brain, 1920 : 117. LECTOTYPE ♀, SOUTH AFRICA, on 'native shrub' (NCI), here designated [examined].

'Adult females congregate on the crown of the host plant at just about ground level.' 'Test of the adult ♀ about 6 mm long, 4·5 mm wide and 3 mm high, regularly oval, or slightly narrowed in front and with the hind margin very slightly flattened, with a faint median indentation. The dorsum is very convex, ventral surface slightly rounded. The test is entire and homogeneous in texture, smooth or very faintly roughened, without ridges, but occasionally with very faint ribbed corrugations at the sides. The colour is of a uniform biscuit tint.' (Brain, loc. cit.)

Dorsal surface membranous, and covered with (i) 8-shaped pores (A) (those nearest the margin perhaps being a little larger than those medially), (ii) minute simple pores (C), (iii) tubular ducts (F), and (iv) rather infrequent minute dorsal setae (D). Cribriform plates (E) present in four rows diverging from the anal area over the more anterior abdominal and thoracic segments; with 3–6 plates per row, each plate with 10–20 pores. Anal plates (H) with rather few ridges, no small pores (though with a few between the lateral plates and the dorsal plate), but two stout

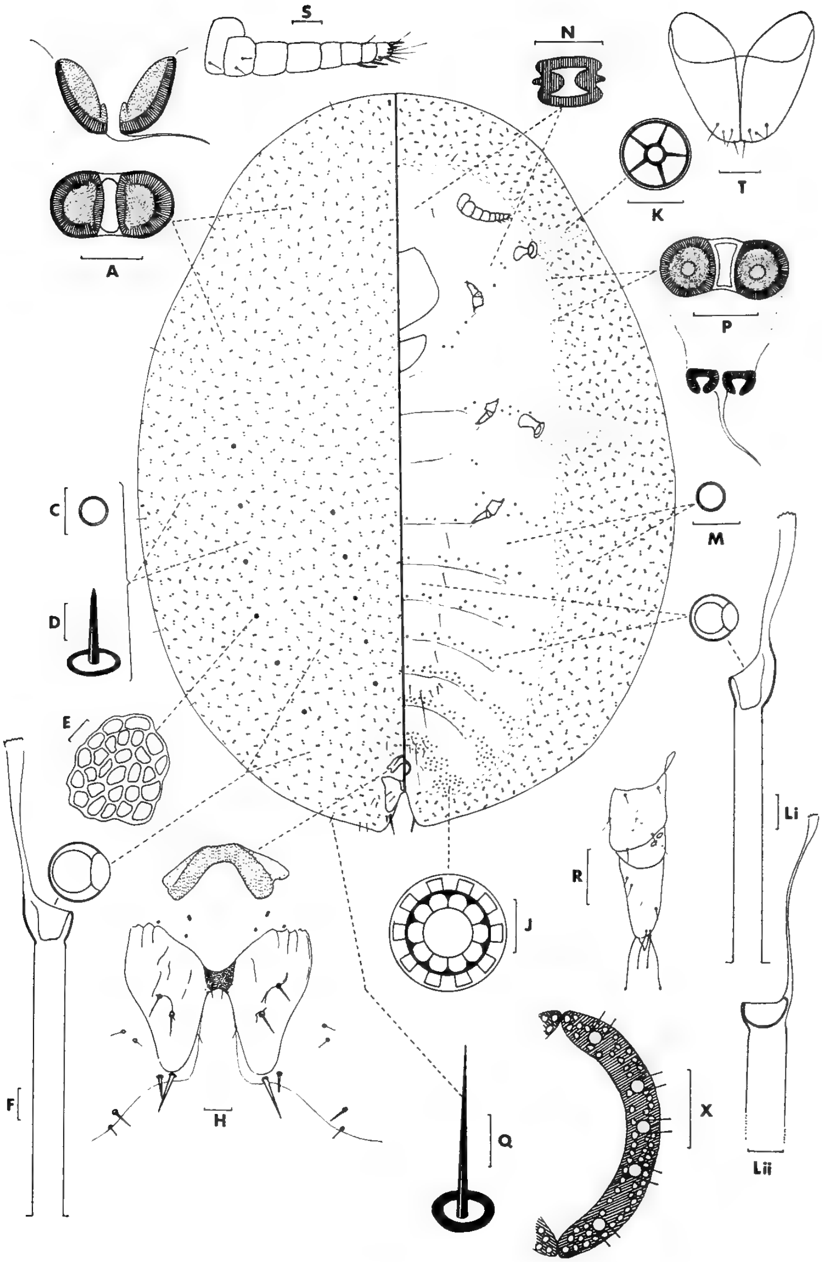

FIG. 8. *Lecanodiaspis magna* Brain.

setae in the middle of each plate; length 110–127 μ; dorsal plate well sclerotized, and rounded laterally. Stigmatic spines entirely absent. Marginal setae (Q) setose, 10 μ long, with about 10 per side, tending to be more spinose posteriorly.

Ventral surface membranous, with multilocular (10) disc pores (J) around the genital opening, and in all the preceding abdominal and thoracic segments, though rather sparse anteriorly, where they are restricted to near the coxae and spiracles. Quinquelocular disc pores (K) in single broad bands between the spiracles and the margin, broadest near the spiracles. Ventral tubular ducts of two sorts: immediately behind the genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is a little broader and the inner ductule a little thinner, but not broadened at the base; elsewhere the ducts (Li) are similar to the dorsal ducts, though a little smaller, and are most frequent medially. Minute simple pores (M) also throughout, but most frequent near the margin. Dorsal 8-shaped pores (A) forming a rather wide band almost reaching the spiracles; within this band is a band of ventral 8-shaped pores (P) about 2 pores wide; further in is a rather broad band of square shaped pores (N) which are found medially to an imaginary line formed by the coxae, antennae and anal plates, with an occasional one medially. Spiracles normal, with the anterior opening 50–58 μ wide. Ventral setae: very long setae found as a pair in the last two pregenital segments; single pairs of medium length setae found medially in all other abdominal segments, and between the antennae; small to minute setae found in groups in the last two pregenital segments, and occasionally submarginally. Legs (R) very much reduced, apparently composed of a coxa, trochanter, and one further segment, with a claw; claw without a denticle; normal fine digitules; dimensions (iii): entire leg 75–90 μ. Antennae (S) of 8–9 segments (eight figured by Brain, though he says nine in the text), all rather annular; length 168–204 μ; terminal fine setae all rather short. Labium (T) one-segmented, with four pairs of small terminal setae, length 82–87 μ. Anal ring (X) heavily sclerotized, with two to three rows of small pores, and ten anal setae. Anal cleft (H) shallow, with a single pair of fine setae anteriorly, where there is a broad area of dense sclerotization joining the two lateral anal plates; there is a further pair of setae along the margins of the cleft. Posterior lobes with a single long seta (23–36 μ long) and a shorter pair (the longer pair were considered to be part of the anal plates by Brain).

Redescribed from the following material labelled *Lecaniodiaspis magna* Brain:

Lectotype ♀, South Africa: Cape Province, Groot Drakenstein, on the crown of a native shrub, June 1916 (*C. W. Mally*), C.K.B.27, NCI.

Paralectotypes: 5 ♀ on 3 slides, with same data as lectotype, 1 ♀ NCI, rest USNM.

Also used in the above redescription were 3 ♀ on 3 slides made from dried material, labelled as above, 2 ♀ BMNH, 1 ♀ NCI.

L. magna is very close to *L. zygophylli* (described below) and *L. africana*; see under these species for comparison.

Lecanodiaspis mimosae (Maskell, 1897)

(Text-fig. 9)

Prosopophora prosopidis var. *mimosae* Maskell, 1897 : 316. Holotype ♀, 1896, W.M.M. (no other data) (Department of Scientific and Industrial Research, Nelson, New Zealand).
Lecaniodiaspis mimosae (Maskell) Cockerell, 1899 : 394.
Lecaniodiaspis mimosae (Maskell); Brain, 1920 : 116.
Lecaniodiaspis mimosae (Maskell); Morrison & Morrison, 1927 : 30.
Lecaniodiaspis mimosae (Maskell); Hall, 1935 : 219.
Lecanodiaspis mimosae (Maskell); Williams & Kosztarab, 1970 : 59.

'Test of adult ♀ about 4·5 mm long, 3·5 mm broad and 1·7 mm thick, with the dorsum almost flat, the upper and lower surfaces almost parallel, with the margins rounded. When not

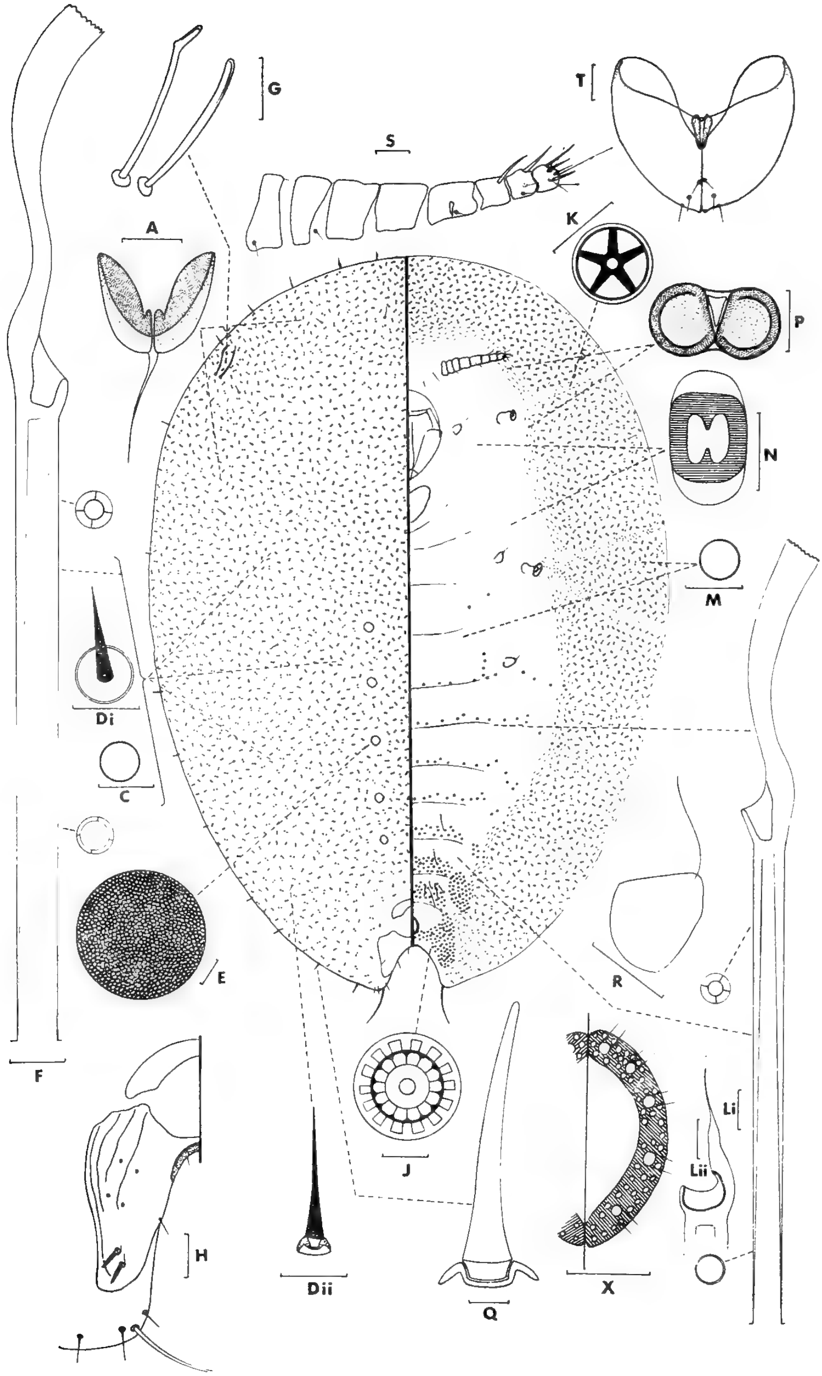

FIG. 9. *Lecanodiaspis mimosae* (Maskell).

crowded together the specimens are glued flat to the bark, button-like, but when a number are massed together they are often distorted. The colour of the young is creamy, but later becomes suffused with brown, with a more distinct median line. The dorsal surface is flaky, without keel or transverse ridges.' '♂ puparium 1·8 mm long, 1 mm broad, elongate oval, rather more pointed in front, flat, with a median keel and faint transverse ridges, pale brown, with a distinct semicircular operculum.' (Brain, loc. cit.)

Mounted material oval to circular, 1·3–4·0 mm long. Dorsal surface membranous, with 8-shaped pores (A) distributed quite densely throughout the dorsal surface in no particular pattern, but those nearer the margin being slightly larger. Also throughout the dorsal surface are minute simple pores (C) and rather long tubular ducts, which have internal ridges in the outer ductule (F). The dorsal setae of two sizes, a minute seta (Di) (4 μ long) is found most commonly near the middle, whilst more laterally are larger setae (Dii) (7–12 μ long); both setae are rather sparse. Cribriform plates (E) in two slightly diverging lines of five quite large plates, each with many pores; they lie entirely within the abdomen. Anal plates (H) well developed, but with relatively few ridges, with two to four small pores towards the centre, and two pairs of spinose setae near the posterior end; length 87–102 μ; dorsal plate with slight indications of a bifid end. Marginal setae (Q) sharply spinose, with 14–15 per side with small basal discs, but distinctly smaller anteriorly; 12–22 μ long. Stigmatic spines (G) restricted to the anterior stigmatic areas, with two spines of approximately the same length, both with slightly spatulate ends; length 29–59 μ.

Ventral surface membranous, with multilocular (10–12) disc pores (J) found quite densely around the genital opening, and in all the preceding abdominal segments, and also in the last two thoracic segments, becoming much scarcer anteriorly. Quinquelocular disc pores (K) in the normal single anterior band and divided posterior band, the bands several pores wide, and broadest nearest the spiracles. A broad band of the larger dorsal 8-shaped pores is found marginally almost as far as the spiracles, and are quite densely placed. Within this zone is a band of ventral 8-shaped pores (P), 2–3 pores wide. Between them and an area roughly indicated by the legs and antennae is a band of square-shaped pores (N). Within this area are found minute simple pores (M), which are much more scarce medially, and ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is a little broader, and the inner ductule a little thinner with a broadened base; elsewhere the ducts (Li) are similar to the dorsal ducts, but slightly smaller. Ventral setae very much reduced, with two pairs between the antennae, and a pair in each of the three pregenital segments; there is also a sparse submarginal ring. Spiracles normal, width of the anterior opening 37–53 μ wide. Labium (T) one segmented, with three pairs of small setae terminally; length 87–95 μ. Antennae (S) of eight rather annular segments, occasionally seven or nine, depending on the pseudo-articulation in the fifth or sixth segments; length 190–238 μ; most of the apical fine setae rather short. Legs (R) reduced to small stumps or absent, with apparently a single long seta. Anal ring (X) with three rows of small pores, and ten setae. Anterior margin of the anal cleft joining the lateral anal plates heavily sclerotized, with a pair of small setae anteriorly, and another pair widely spaced laterally. Posterior lobes (H) with a single pair of long setae (52–69 μ), and two to three pairs of short setae.

Redescribed from the following material labelled *Lecaniodiaspis mimosae* (Maskell):

SOUTH AFRICA: Cape Town, ex Mimosa (*Acacia* sp.), 14.vi.1896 (*C. P. Lounsbury*), ♀, USNM; Transvaal, Vanderbijl Park, ex *Acacia karroo* (Leguminosae), 12.iv.1962 (*J. Munting*), 2♀, NCI; Cape Province, Addo, ex *Acacia* sp., Dec. 1969 (*J. F. de Villiers*), 4 ♀, NCI; Cape Province, Fort Beaufort, ex *Acacia horrida*, Sept. 1900 (*C. P. Lounsbury*), 2♀, USNM. SOUTH WEST AFRICA: Windhoek, on *Acacia giraffae*, Jan 1900 (*J. C. Watermeyer*), NCI; no locality, ex *Mimosa* (*Acacia*) *giraffae*, Lounsbury coll., no date, 2 ♀, USNM.

It is possible that the 1896 material is that from which Morrison and Morrison redescribed this species in 1927. It lacks the serial number (533), and the USNM

catalogue number 40372 however, but this material seems to be otherwise absent from US collection.

This species shares certain characters with *L. erratica*, *L. natalensis* and *L. brachystegiae*. They are as follows: (i) tubular ducts with internal ridges; (ii) limbs very much reduced or absent; (iii) dorsal 8-shaped pores of two sizes, the larger forming the marginal ring (in *mimosae* the lateral pores are barely larger than those elsewhere). *L. mimosae* differs from *L. erratica* and *L. natalensis* in (i) having ten setae in the anal ring; (ii) having a fairly normal antenna; (iii) having stigmatic spines, although these are reduced to the anterior cleft; and (iv) in having fully developed quinquelocular pore bands. The arrangement of the cribriform plates and the form of the anal plates also differ. The main differences from *L. brachystegiae* are given on p. 424.

Lecanodiaspis natalensis Brain, 1920

(Text-fig. 10)

Lecaniodiaspis natalensis Brain, 1920 : 116. LECTOTYPE ♀, South Africa, on *Hibiscus* sp. (NCI), here designated [examined].

'Test of adult ♀ about 2·5 mm long and 1·6 mm broad at the widest part, which is about the middle, flat, somewhat elliptical with the two ends narrowed. In some cases the anterior end is broadly rounded and the posterior extremity pointed. The dorsum is flat and covered with a layer of white material, which is distinctly divided into three series of ± rectangular plates, the appearance of which suggested *Orthezia*. The median series is not quite as broad as the two lateral ones and consists of nine patches, the number which is apparently constant for each of the two lateral series also.' (Brain, loc. cit.)

Mounted material 1·3–2·1 mm long, generally rather pointed at the posterior end, and occasionally at the anterior end also. Dorsal surface membranous, covered in 8-shaped pores (B), which appear to have no particular pattern, but are distinctly larger marginally (A). Found throughout the dorsal surface are minute simple pores (C), tubular ducts (F), the outer ductule of which is internally ridged, and, much less frequently, minute dorsal setae (D). Cribriform plates (E) either absent or exceedingly few (in the available six specimens there were two single plates); they were round and had numerous pores. Anal plates (H) normal, though tending to lie vertically on the slide, thus making the structure difficult to see; length 45–54 μ, when seen flat the ridges are not very pronounced, but appear to be very definite when seen laterally; with two stout setae near the posterior end; dorsal plate as usual, widest laterally. Stigmatic spines entirely absent. Marginal setae rather few.

Ventral surface membranous, with multilocular (10–12) disc pores (J) around the genital opening and in all the preceding abdominal and thoracic segments, and with a single pair lateral to the labium in the head; they get progressively scarcer anteriorly. Quinquelocular disc pores (K) reduced to small groups of 5–8 pores in the immediate vicinity of the spiracles. Marginally, the larger 8-shaped pores form a band of moderate width, inside which is a band 2–3 pores wide of ventral 8–shaped pores (P), whilst between this band and the spiracles is a fairly broad band of square-shaped pores (N). Throughout the ventral surface are minute simple pores (M), though these are rather scarcer medially; also ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is a little broader and the inner ductule a little thinner with a broadened base; elsewhere the ducts (Li) are similar to the dorsal ducts, but slightly smaller. Ventral setae scarce, with a single pair of short setae between the antennae, and medially in each of the abdominal segments, and also forming a submarginal band; there are also several groups of small setae medially in the two pregenital segments. Spiracles normal; width of the anterior opening 28–29 μ. Labium (T) one-segmented, with three pairs of small terminal setae; length

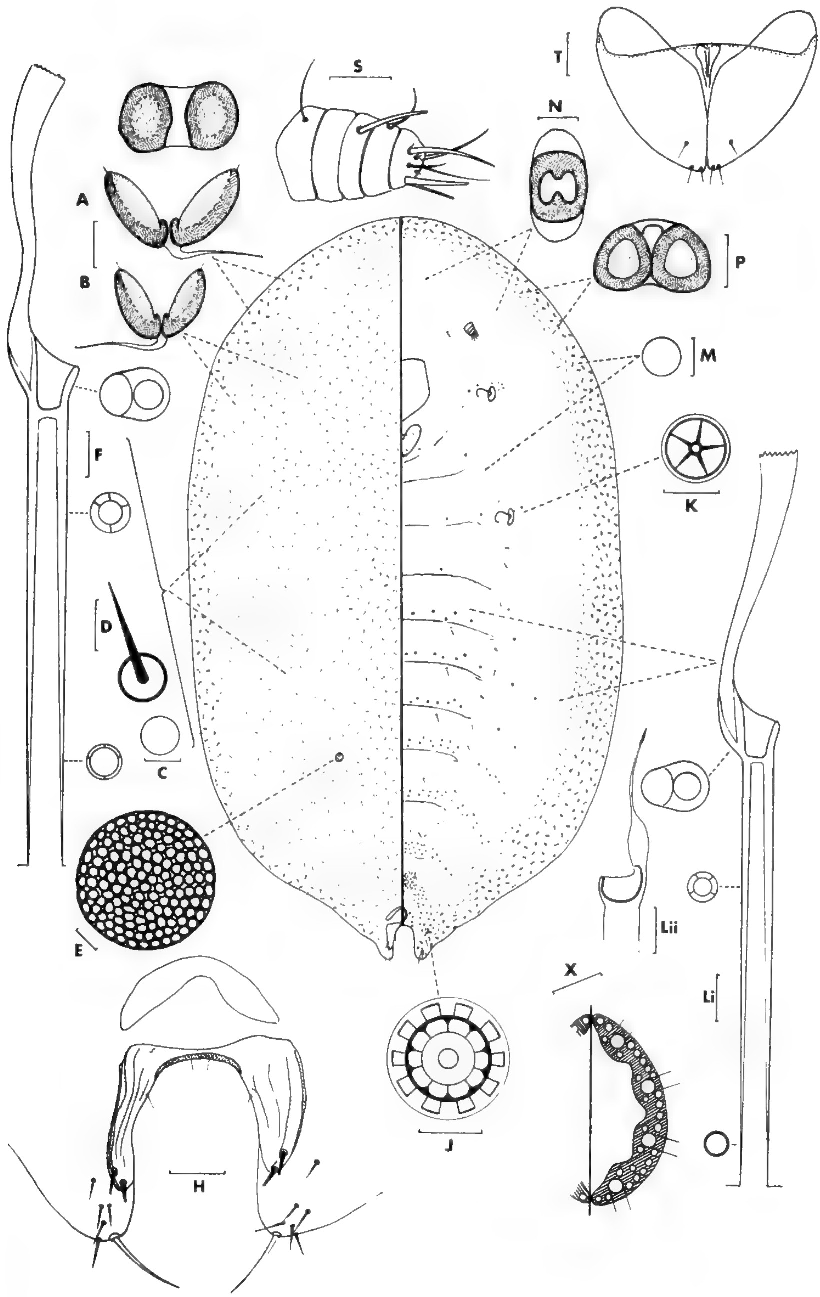

FIG. 10. *Lecanodiaspis natalensis* Brain.

81–85 μ. Legs entirely absent. Antennae (S) much reduced to five ring-like segments, with all the fine setae short; length 40–50 μ. Anal ring (X) with eight anal setae; rather narrow, with one complete ring and one incomplete ring of small pores. Anal cleft (H) with a broad area of dense sclerotization anteriorly with a single pair of setae, and with another pair laterally; there are generally 2–4 between the cleft and the genital opening. Posterior lobes (H) with a single pair of long setae (40–50 μ), and 4–6 pairs of short setae.

Redescribed from the following material labelled *Lecaniodiaspis natalensis* Brain:

Lectotype ♀, South Africa: Durban, on *Hibiscus* sp. (Malvaceae), 20.vii.1916 (*C. P. van de Merwe*), CKB 301, NCI.

Paralectotypes: 4 ♀ on 4 slides with same data as lectotype; 3 in USNM and 1 in NCI.

Also used in the description was a single specimen mounted from dried material labelled as above, deposited in BMNH.

See under *L. erratica* and *L. mimosae* for comments.

Lecanodiaspis parinarii Hall, 1935

(Text-fig. 11)

Lecaniodiaspis parinarii Hall, 1935 : 219. LECTOTYPE ♀, Rhodesia, on *Parinarium curatellifolia* (BMNH), here designated [examined].

'Test of the adult female broadly ovate and flat convex. The shape is very variable being much influenced by the very rough and uneven nature of the bark of the host plant. Colour usually drab, but individuals have been seen in which it is almost ochreous. The surface of the test is somewhat rough owing to several slightly raised and flattened protuberances; these are obscure, except with the aid of the binocular microscope, and exhibit no definite arrangement . . . Length of the test of the adult female 3·0–3·5 mm; breadth 2·5–3·0 mm . . . Young individuals very flat, shiny brown, covered with a fine film of white translucent matter. A distinct median longitudinal carina is present and several less distinct carinae running from thence to the margin. In dead specimens the margin is usually slightly upturned.' (Hall, loc. cit.)

Mounted material oval to almost circular, membranous, 1·0–2·1 mm long. Dorsal surface with numerous 8-shaped pores of two sizes, the larger (A) forming a reticulate pattern, and a marginal band, with the smaller pores being found throughout the rest of the dorsal surface. Also throughout are minute simple pores (C), and tubular ducts (F) with an internally ridged outer ductule. The dorsal setae vary considerably in size, being much smaller medially than near the margin, where they are about the size of the marginal spines; they all have enlarged basal discs. Cribriform plates (E) almost circular, quite large with numerous pores, in two almost parallel lines of 1–3 plates. Anal plates (H) normally developed, with longitudinal ridges moderately developed, with two stout spines postero-laterally, and with no small pores; length 65–75 μ; dorsal plate fairly narrow, semicircular. Marginal setae (Q) very similar to the larger dorsal setae, with large basal discs, with about 14–16 on each side, and about 18 μ long. Stigmatic spines (G) present with two in the anterior group, and one each in the two posterior stigmatic areas; in the available material they appear to lack a spatulate end, and have a small terminal pore; length of the anterior spines 54–69 μ and 22–29 μ respectively; posterior spines 46–66 μ and 33–58 μ.

Ventral surface with multilocular (10) disc pores (J) absent from the genital segment, but abundant in each of the preceding abdominal segments, and in the metathorax; they are also found much less frequently in the other thoracic segments and near the antennae. Quinquelocular disc pores (K) in the normal single anterior and split posterior pore bands, the bands being

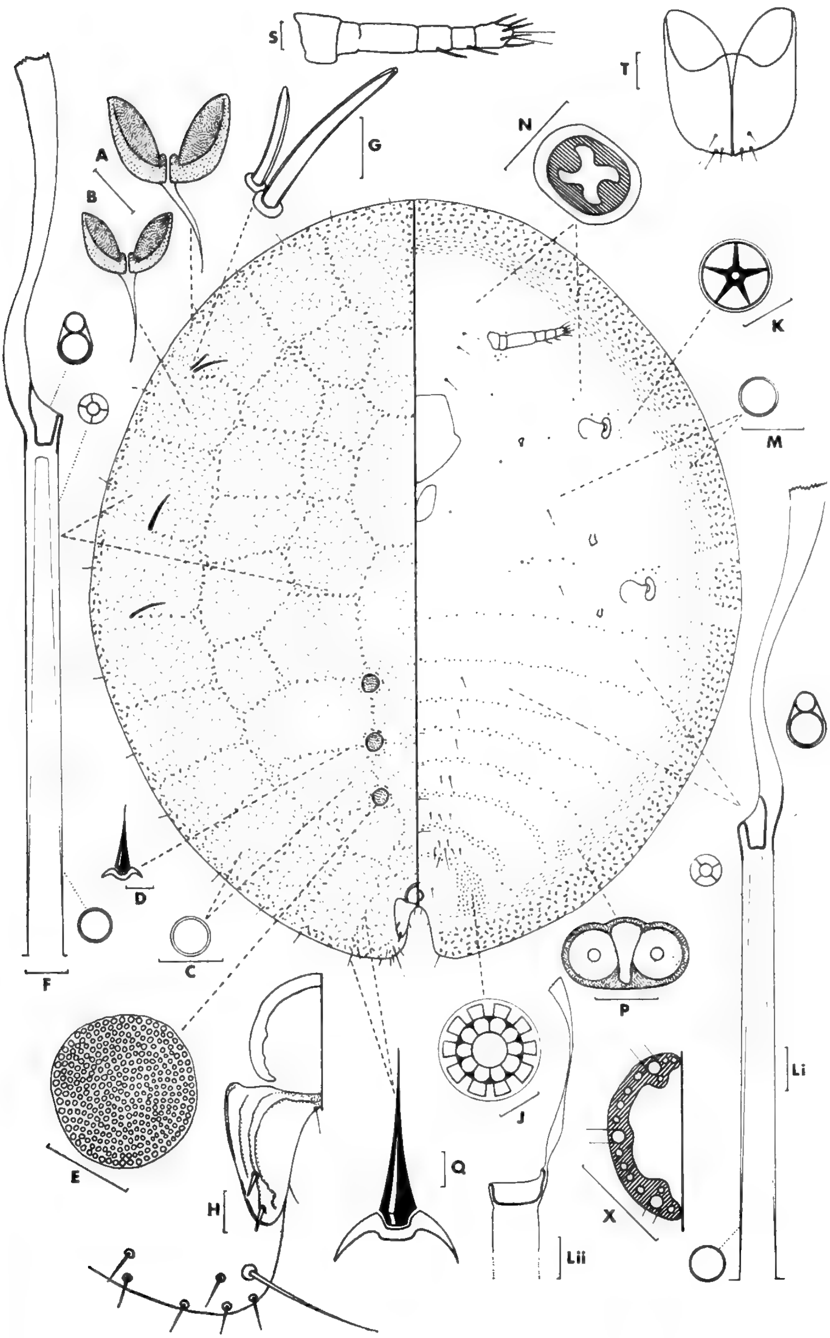

FIG. 11. *Lecanodiaspis parinarii* Hall.

broadest near the spiracles, becoming only about two pores wide near the margin. Ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere, except that the outer ductule is much broader, and the inner ductule thinner with a broadened base; elsewhere the ducts (Li) are similar to the dorsal ducts, though slightly smaller. Minute simple pores (M) most frequent marginally. The larger dorsal 8-shaped pores form a moderate marginal band, within which lies a band of ventral 8-shaped pores (P) about 4–6 pores wide. Between this band and a line formed by the spiracles, antennae and the anal plates, lies a fairly broad band of small square-shaped pores (N). Ventral setae rather sparse, but with three pairs between the antennae, a pair in the meso- and meta-thorax, and medially in each of the abdominal segments; with other smaller setae in the last three pregenital segments, and with a sparse sub-marginal ring. Spiracles normal, though perhaps relatively a little large: width of anterior opening 46–55 μ. Legs normally entirely absent, but may be represented by very small membranous outgrowths. Antennae (S) from 4–7 segmented, though most frequently five, depending on the pseudo-articulation of the second segment; with only two short fine setae on the terminal segment; length 150–185 μ. Labium (T) one-segmented, rather square, with three pairs of small terminal setae; length 85–95 μ. Anal ring with only six anal setae; with one complete and one very incomplete ring of small pores. Anal cleft with one pair of fine setae anteriorly, where the lateral plates are joined by an area of dense sclerotization; with a further pair of setae laterally; there is also a pair between the cleft and the genital opening. Terminal lobes (H) with a single pair of long setae (35–78 μ), and with two to five pairs of smaller setae.

Redescribed from the following material labelled *Lecaniodiaspis parinarii* Hall:

Lectotype ♀, RHODESIA: Macheke, ex *Parinarium mobola* [now *P. curatellifolia*] (Rosaceae), 29.xi.27 (*W. J. Hall*, 137), BMNH. This slide has two specimens, one of which has been designated lectotype, the other paralectotype.

Paralectotypes. Three slides with 6 specimens, with same data as lectotype except that one slide is dated 23.iv.28, (*W. J. Hall*, 485), BMNH.

This species is immediately separable from all other species in Africa in having only six setae in the anal ring. It shares with the *L. brabei–L. tarsalis* group dorsal and marginal setae with enlarged basal discs, and the larger 8-shaped pores also being found marginally in the dorsum. It is however closer to the *L. erratica–L. mimosae* group with which it shares the following characters: i. tubular ducts with internal ridges; ii. legs very much reduced or absent; iii. cribriform plates with numerous pores; and iv. the ventral square-shaped pores being relatively larger than in the other group.

Lecanodiaspis tarsalis Newstead, 1917

(Text-fig. 12)

Lecaniodiaspis tarsalis Newstead, 1917 : 16. LECTOTYPE ♀, SOUTH AFRICA, on 'native tree' (BMNH), here designated [examined].
Lecaniodiaspis tarsalis Newstead; Brain, 1920 : 118.
Lecaniodiaspis tarsalis Newstead; Hall, 1935 : 221.
Lecanodiaspis tarsalis Newstead; Williams & Kosztarab, 1970 : 85.

'Female test. Colour warm buff; narrowed slightly posteriorly; dorsum convex, with a median interrupted longitudinal ridge, and about twelve transverse ones on each side. Orifica terminal, circular; projecting from it in some individuals, is a short waxen filament. Texture dense; surface with exceedingly minute whitish particles. Length 2–2·1 mm; width 1·2–1·3 mm.' (Newstead, loc. cit.)

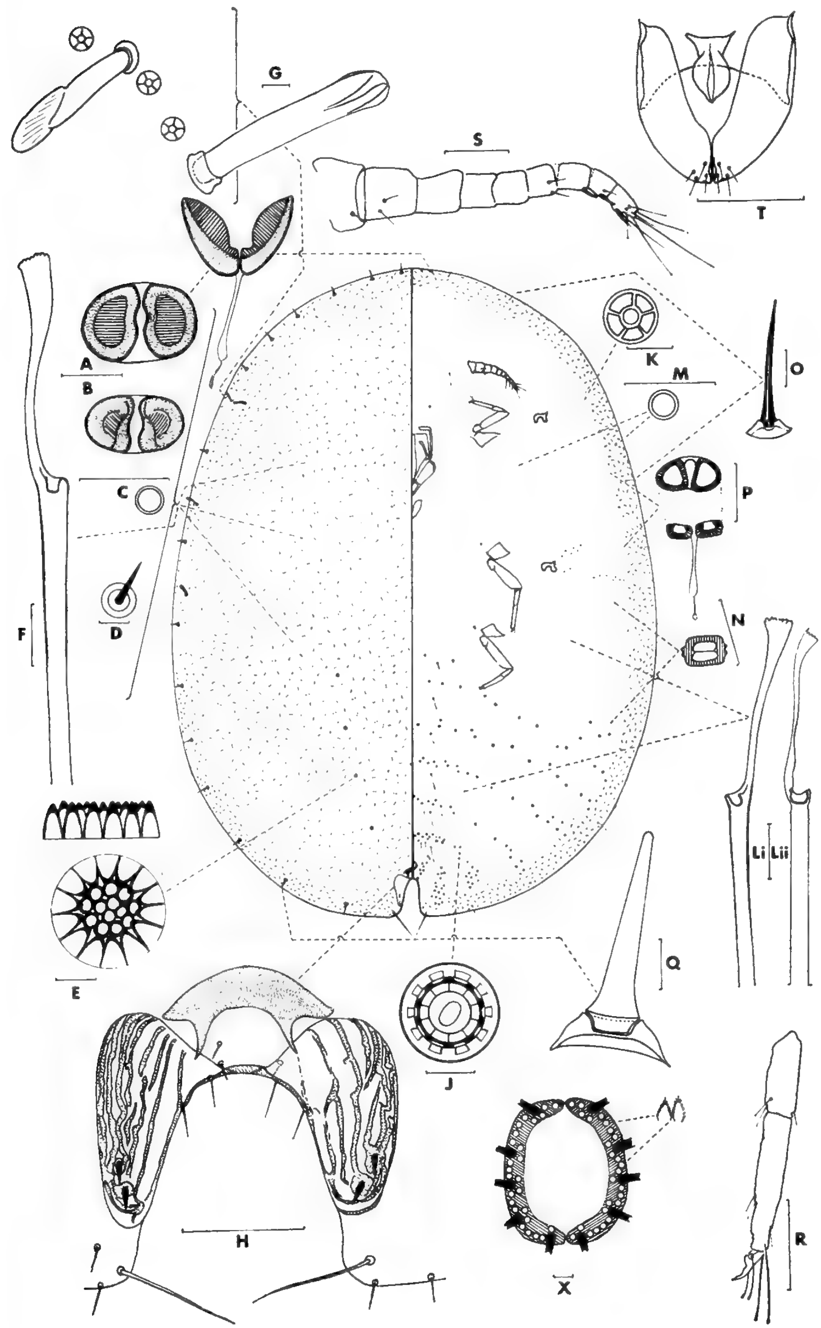

FIG. 12. *Lecanodiaspis tarsalis* Newstead.

Mounted material 1·5–3·0 mm long, and regularly oval in shape. Dorsal surface membranous, with 8-shaped pores of two sizes, the larger (A) apparently found segmentally, and the smaller (B) intersegmentally; the pores appear to be more frequent near the margin. Also throughout the dorsal surface are minute simple pores (C), tubular ducts (F) and, rather infrequently, minute setae (D). Cribriform plates in two almost parallel lines of 3–4 plates in the anterior abdominal segments; flat to concave, and with 10–25 small pores per plate. Anal plates (H) normal, with well developed longitduinal ridges, with no pores, but with two stout setae towards the posterior end; length 73–95 μ; dorsal plate quite broad, with two wide extensions posteriorly. Stigmatic spines present, in three groups, all rather spatulate; anterior spines (G) 35–40 μ and 17–22 μ respectively, and the posterior spines 7–25 μ and 9–22 μ. Marginal spines (Q) large, bluntly pointed, with very large basal discs; 17–24 μ long, and with 15–17 per side.

Ventral surface membranous, with multilocular (10) disc pores (J) around the genital opening and in all the preceding abdominal segments; they are also present in a small group in the genital segment, but they appear to be absent from the thorax. Quinquelocular pores (K) in the normal single anterior and divided posterior bands, the anterior band a little broader than the posterior bands, and with the pores most frequent marginally. Throughout the ventral surface are minute simple pores (M), which are much more frequent marginally; and tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those elsewhere except that the inner ductule is much thinner, and the cup-end of the outer ductule is differently shaped; elsewhere the ducts (Li) are similar to the dorsal ducts but considerably smaller. The larger dorsal 8-shaped pores (A) form a rather narrow marginal band, within which is a very narrow band (1–2 pores wide) of ventral 8-shaped pores (P); whilst within this is a very sparse band of minute square-shaped pores (N) which are found to about 2/3rds of the way to the spiracles. Ventral setae: fairly large setae are found as two pairs between the antennae, single pairs associated with the coxae, and medially in each of the abdominal segments, and forming a submarginal ring; there are also groups of small setae in the genital and two pregenital segments. Spiracles normal, width of the anterior spiracular opening 25–29 μ. Antennae (S) normally of nine segments, the terminal segments usually with one to two rather fine, long setae; length 228–250 μ. Legs well developed, though a little small, with no tibio-tarsal articulatory sclerosis, with a small denticle on the claw, and with fine digitules; the tibia 1/2–1/3rd length of tarsus; dimensions (iii): trochanter plus femur 117–145 μ, tibia plus tarsus (R) 122–145 μ. Labium (T) one-segmented, with four pairs of small terminal setae; length 70–75 μ. Anal ring with one complete and one very incomplete row of small pores; with ten setae in the anal ring. Anal cleft with a distinctly sclerotized anterior margin between the lateral anal plates, and with two pairs of quite robust setae. Posterior lobes (H) with a single pair of long setae (55–72 μ), and with 2–5 pairs of small setae.

Redescribed from material labelled *Lecaniodiaspis tarsalis* Newstead:

Lectotype ♀, SOUTH AFRICA: Pretoria, on Native Tree, 1914 (*de Charmoy*), Dept. Agric. Mauritius, Newstead 13/322. BMNH Reg No. 1916.15. This slide contained three specimens, one of which has been designated lectotype, the other two paralectotypes.

Also seen:

SOUTH AFRICA: Transvaal, Pretoria ex *Hibiscus* sp. (Malvaceae), 4.x.65, (*J. Munting*), NCI; Transvaal, Vaalwater, ex *Dombeya rotundifolia* (Sterculiaceae). 2.ii.68 (*H. A. D. van Schalkwyk*), NCI; Transvaal, Loskop Dam, ex *Dombeya* sp., Jan. 1970 (*N. J. van Rensburg*). RHODESIA: Mazoe, ex *Hibiscus* sp., 19.x.27 (*W. J. Hall* (72)), MAS; Salisbury, Parkdown Nursery, ex *Hibiscus* sp., 21.x.64 (*M. E. Richardson*), MAS; Queensdale, on *Gardenia* sp. (Rubiaceae), 21.viii.67 (*J. Blowers*), MAS; Pomona, on the twigs of *Plumbago* sp. (Plumbaginaceae), 12.xi.62

(*van de Arend*), MAS; Gwelo, *Hibiscus* sp., 1.iv.64 (collector unknown), MAS; South Marandellas, ex *Dombeya rotundifolia*, 21.x.35 (*W. J. Hall* 811), BMNH.

This species would appear to be rather more widespread in Rhodesia now than when Hall was collecting, and is a minor pest of nursery stock.

L. tarsalis belongs in the same group as *L. brabei*, under which the group is discussed. It is distinguishable from the others in this group by (i) having the cribriform plates restricted to four pairs in the abdomen; (ii) in having multilocular disc pores in a small group in the genital segment (otherwise only found in *L. brabei*); (iii) in having 1–2 long fine setae terminally on the antennae; (iv) in the lengths of the legs which are longer than the antennae, and (v) in the dorsal anal plate, which has the two pronounced projections posteriorly.

Lecanodiaspis zygophylli sp. n.

(Text-fig. 13)

Unmounted material highly convex, with a shallow median longitudinal ridge, with shallow ridges running laterally from it, but with an unridged lateral area. Colour of the material stored in alcohol dark brown when old, but pale brown when young. Mature females with a covering of felt-like material. When mature, the adult female withdraws her abdomen, leaving a space at the posterior end of the cavity, which becomes filled with eggs and some cottony material.

Mounted material membranous, 1·6–3·6 mm long, elongate oval, but slightly constricted anteriorly in some specimens. Dorsal surface with two sizes of 8-shaped pores, the larger (A) forming a fairly wide marginal band and thin ridges across the abdominal segments, but covering the greater part of the thorax and head, where the exact distribution is difficult to discern; the smaller 8-shaped pores are found throughout the rest of the dorsal surface. Found frequently throughout are minute simple pores (C) and tubular ducts (F). Minute dorsal setae (D) very sparse. Cribriform plates (E) found in four more or less parallel lines diverging from the anal plates, with 3–6 plates in the outer rows, and 5–6 plates in the medial rows; each plate has numerous pores, though sometimes the more anterior plates become reduced in size. Anal plates (H) normal, with well developed ridges, 0–2 small pores, and with two stout spines towards the posterior end; length 151–163 μ; dorsal plate rather flat and narrow. Stigmatic spines entirely absent. Marginal setae (Q) rather sparse with 6–12 on each side, stoutly spinose at each end, becoming finely spinose laterally.

Ventral surface with multilocular (10–12) disc pores (J) usually present in the genital segment and in each of the preceding abdominal segments, in the thorax, and with a single pore usually present near the antennae. Quinquelocular disc pores (K) in single bands between the spiracles and margin, broadest near the spiracles. The larger 8-shaped pores form a broad band marginally, within which is a narrow band (2–3 pores wide) of ventral 8-shaped pores (P). Between this band and the antennae, legs and anal plates is a band of minute square-shaped pores (N). Minute simple pores (M) occur throughout, though more frequently marginally. Ventral tubular ducts of two types: immediately posterior to the genital opening is a small group of ducts (Lii) similar to those found elsewhere except that the inner ductule is very fine, and the cup-shaped inner end of the outer ductule is of a different shape; elsewhere the ducts (Li) are similar to the dorsal ducts but a little smaller. Long ventral setae found in single pairs in each of the abdominal segments and between the antennae; short setae found as a sparse sub-marginal ring and in small groups in the last two pregenital segments; there is also a pair near the coxae. Spiracles perhaps a little large, width of the anterior opening 57–69 μ. Labium (T) one-segmented, slightly bowl shaped, with five pairs of small terminal setae; length 98–104 μ. Antennae (S) eight-segmented, 244–260 μ long, and with fine setae on the terminal segment all quite

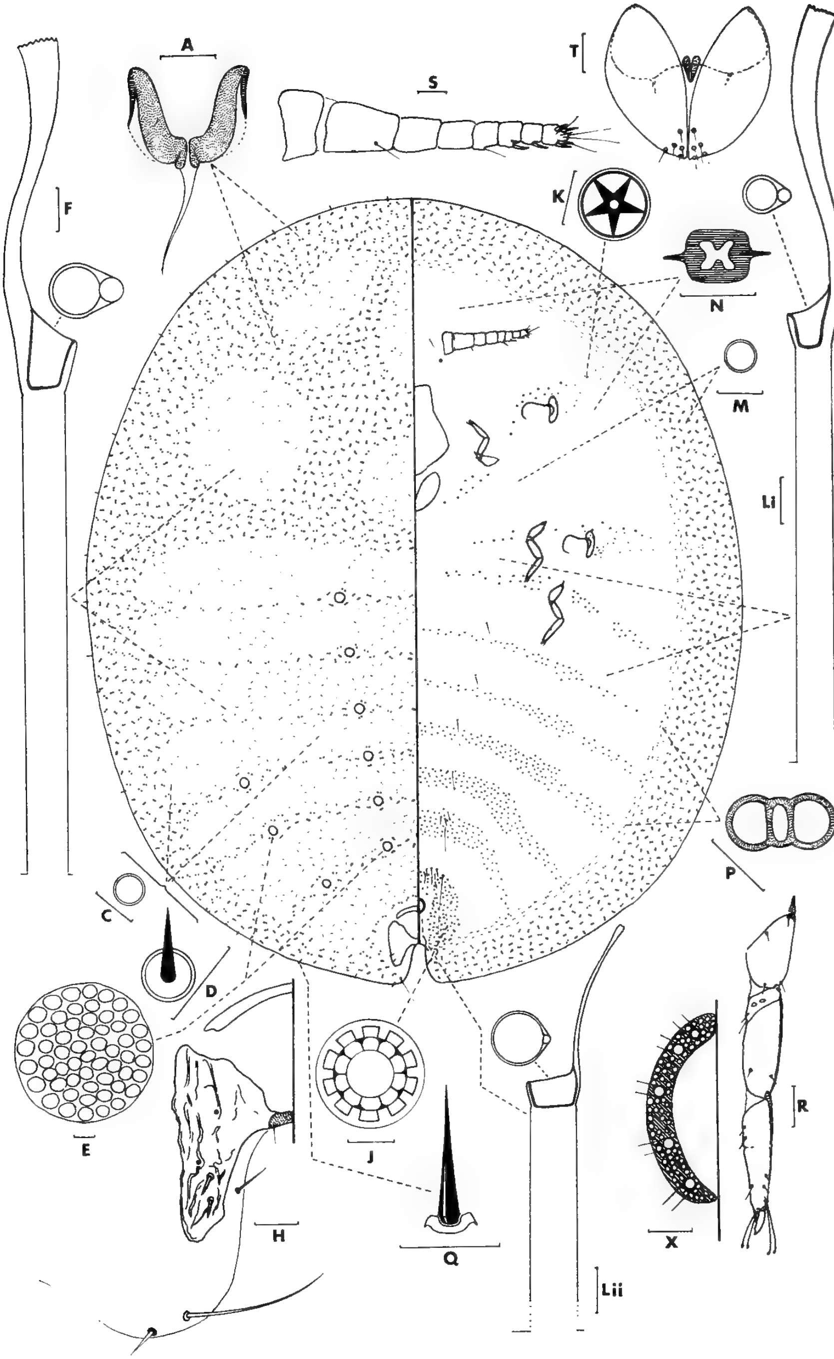

FIG. 13. *Lecanodiaspis zygophylli* sp. n.

short. Legs (R) relatively small, with the tibia and tarsus fused, though the degree of fusion varies slightly; with a distinct denticle on the claw and with fine digitules; dimensions (iii): trochanter plus femur 59–73 μ; tibia plus tarsus 70–87 μ. Anal ring (X) with five pairs of anal setae, and with three almost complete rows of small pores. Anal cleft (H) with an area of sclerotization joining the two lateral anal plates, with one to two pairs of short setae, and with a further longer pair laterally. Terminal lobes (H) with a single pair of long setae (39–49 μ), and 1–2 pairs of short setae.

Holotype ♀, MAURITANIA: Coppolani, ex twigs of *Zygophyllum waterlotii* (Zygophyllaceae), 26.viii.1956 (*Ch. Rungs*), MNHN, No. 2701.

Paratypes, MAURITANIA: Coppolani, ex twigs of *Zygophyllum waterlotii*, 26.viii. 1956 (*Ch. Rungs*), 30 ♀ on 30 slides deposited as follows: 12 slides and some specimens in alcohol in MNHN; 12 slides and some specimens in alcohol in BMNH; and two slides in each of the following: USNM, NCI and Department of Entomology, Virginia State University.

L. zygophylli is very close to *L. magna*, but differs (i) in having dorsal 8-shaped pores of two sizes, the larger being found medially as well as marginally; (ii) in having much larger cribriform plates; (iii) in that the two spines on each of the lateral anal plates are found terminally rather than medially; (iv) in that the femur is not fused with the tibia and tarsus, and (v) in having much more frequent multilocular disc pores. For further comments see under *L. magna*. It is also very similar to *L. africana*, but differs in possessing four rows of cribriform plates. The 1st instar nymphs also differ, in that those of *L. zygophylli* have three quinquelocular disc pores in the anterior pore band rather than two as in *L. africana* (Williams & Kosztarab, 1970).

POSSIBLE INTER-RELATIONSHIPS OF THE SPECIES

At present thirteen species of the genus *Lecanodiaspis* Targioni-Tozzetti are known from Ethiopian Africa. Their known distribution is biased towards the southern end of the continent (Text-fig. 14), for only three of these species have been recorded north of the Zambezi River, the rest occurring mainly in South Africa. This may be partly due to the more intensive collecting in southern Africa, but as members of each of the groups discussed below are found in South Africa, it is probable that the main centre for this genus in Africa lies in the south.

These species fall into three well-defined groups:

Group I: *L. brabei* Brain
L. elytropappi Munting & Giliomee
L. erica Hodgson
L. tarsalis Newstead *
L. dorsospinosa Hodgson

The main characters of this group are described under *L. brabei* (p. 422). These species are found mainly in South Africa, except *L. tarsalis*, which is also known to be

* The brackets indicate the degree of closeness of the species in each group.

a minor pest of nursery stock in Rhodesia; these plants are imported mainly from South Africa, and hence it seems probable that *L. tarsalis* has spread from the south.

Group II: *L. erratica* De Lotto
L. natalensis Brain
L. brachystegiae Hall
L. mimosae (Maskell)
L. parinarii Hall *

This group has a number of common characters not shared with the other groups, but is not as uniform as group I. These characters are discussed mainly under *L.*

* The brackets indicate the degree of closeness of the species in each group.

FIG. 14. Map showing the distribution of the species of *Lecanodiaspis* Targioni-Tozzetti in the Ethiopian Region.

erratica (p. 433), *L. mimosae* (p. 438) and *L. parinarii* (p. 442). This group is also mainly from southern Africa, except *L. erratica*, which has only been recorded from cultivated coffee in Kenya, where it is a minor pest. The genus *Coffea* is widespread in Africa, and hence *L. erratica* may be more widely distributed than the records suggest.

Group III: *L. africana* Newstead
L. magna Brain *
L. zygophylli Hodgson

The main features of this group are given under *L. africana*, which is a minor pest in north Africa and in the eastern Mediterranean countries. *L. magna* and *L. zygophylli* are known only from their type-localities at opposite ends of the continent. Thus, the main centre of this group is hard to define, but it may not be in the south.

These species have been recorded from a wide range of plant families. Although there is a tendency for closely related species to be found on closely related plant families, conclusive evidence for this relationship is lacking.

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EXPLANATION OF THE FIGURES

Each plate represents the adult female, with the main features of the dorsal surface on the left side of the central drawing, and those of the ventral surface on the right. The key to the lettering is as follows: A, larger or only type of dorsal 8-shaped pore; B, smaller dorsal 8-shaped pore; C, dorsal minute simple pore; D, Di, Dii, dorsal setae; E, cribriform plates; F, dorsal tubular ducts; G, Gi, Gii, Giii, stigmatic spines; H, anal cleft, with anal plate, dorsal plate and posterior lobes with their setae; J, multilocular disc pore; K, quinquelocular disc pore; Li, Lii ,ventral tubular ducts (generally only part of Lii is illustrated, but the ductules are usually about the same length as those of Li); M, ventral minute simple pore; N, ventral square-shaped pore;

* The brackets indicate the degree of closeness of the species in each group.

O, ventral submarginal setae; P, ventral 8-shaped pore; Q, marginal seta; R, whole or portion of metathoracic (iii) limb; S, entire antenna; T, labium; X, anal opening.

The lengths of the scale-lines are as follows. A-F and J-Q = 3 μ, with the following exceptions: Text-fig. 3, E = 20 μ; Text-fig. 10, M = 1 μ; Text-fig. 12 F, L and Q = 5 μ. G, H, R, S, T and X = 25 μ, except for Text-figs 3, 4, 7, 9, 10 and 11, in which these scale-lines = 20 μ, and Text-fig. 12, in which G and X = 5 μ, and H, R, S and T = 50 μ.

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INDEX TO SPECIFIC NAMES

Figures in *italics* indicate page where species is described, and those in **bold** where it is figured.

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INDEX TO NOMENCLATURAL CHANGES IN VOLUME XXVII

As all the parts of the Entomological Series of the Bulletin now include their own indexes, it has been decided to discontinue the comprehensive volume index. From this volume onwards the index will include only new names and names involved in nomenclatural changes.

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